Health Canada Santé Canada

Bureau of HIV/AIDS, STD & TB
Laboratory Centre for Disease Control
Health Canada

HIV/AIDS Epi Updates

April 2000

Canada

Health Canada
Health Protection Branch

Santé Canada
Direction générale de la protection de la santé
Division of HIV Epidemiology
Bureau of HIV/AIDS, STD and TB
Brooke Claxton Building, Room 0108B
Tunney's Pasture, PL 0900B1
Ottawa, Ontario, K1A 0L2
Tel: (613) 954-5169
Fax: (613) 954-5414

102-04878/

Information to the readers of HIV/AIDS *Epi Updates*

The Division of HIV Epidemiology of the Bureau of HIV/AIDS, STD and TB, Laboratory Centre for Disease Control, Health Protection Branch, Health Canada, is pleased to provide you with the April 2000 publication of HIV/AIDS *Epi Updates*.

As part of its mandate, the Bureau of HIV/AIDS, STD & TB conducts national surveillance and research on the epidemiology and laboratory science related to HIV/AIDS, sexually transmitted diseases (STD) and tuberculosis (TB). As part of this mandate, *Epi Updates* are compiled to summarize recent trends and developments related to the HIV epidemic in Canada.

This publication includes several new *Epi Updates* and a number of *Epi Updates* that have been updated for April 2000. In addition, there are some *Epi Updates* included in previous publications that have not been included in the current publication because they refer to information pertaining to a specific point in time (for example, "Anonymous HIV Testing in Canada", May 1999). All *Epi Updates* are available at the address noted above and also at our website: www.hc-sc.gc.ca/hpb/lcdc/bah.

The HIV/AIDS *Epi Updates* are complementary to other Bureau materials which are also available at the website.

Sincerely,

Chris Archibald MDCM, FRCPC
Chief

Canada

HIV/AIDS
Epi Updates

April 2000

Contents

AIDS and HIV in Canada 1

HIV Prevalence and Incidence in Canada:
40,100 Living with HIV Infection and 4,200 New Infections Per Year 4

HIV Testing Among Canadians:
15,000 Current HIV Infections May Not Be Diagnosed 7

HIV Infection Reporting in Canada 10

Positive HIV Test Reports in Canada 14

HIV and AIDS Among Youth in Canada 17

HIV and AIDS Among Women in Canada 23

Perinatal Transmission of HIV 26

HIV/AIDS and Ethnicity in Canada 32

HIV and AIDS Among Aboriginal People in Canada 35

HIV/AIDS Among Men Who Have Sex With Men 40

HIV/AIDS Among Injection Drug Users in Canada 44

Risk Behaviours Among Injection Drug Users in Canada 48

Oral Sex and the Risk of HIV Transmission 53

HIV Strain Surveillance in Canada 57

Primary HIV Anti-retroviral Drug Resistance in Canada 62

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

AIDS and HIV in Canada

Introduction

Since the beginning of the epidemic to December 31, 1999, a total of 45,534 positive HIV tests and 16,913 AIDS cases have been reported to the Laboratory Centre for Disease Control (LCDC) at Health Canada from all provinces and territories of Canada. This *Epi Update* summarizes available data on diagnosed HIV infection and reported AIDS cases in Canada, and updates the current information on the status of the Canadian HIV/AIDS epidemic.

HIV Positive Test Reports

The annual number of positive HIV tests reported since 1995 has been slowly declining. In fact, 25.4% fewer positive HIV tests were reported to LCDC at the end of 1999 (2,231) than in 1995 (2,989)[1]. Factors such as who comes forward for testing (testing patterns), risk-reducing strategies, and reporting delays and under-reporting of positive HIV tests may contribute to this observed decline.

Character of the HIV Epidemic Shifting

The HIV epidemic in Canada is changing from the early epidemic that primarily affected men who have sex with men (MSM) and those who received blood and blood products to the current epidemic that primarily affects injection drug users (IDU), MSM and, increasingly, women. The proportion of new HIV diagnoses among adults attributable to MSM has decreased from 74.7% during 1985-94 to 37% during 1997-99. On the other hand, the proportion attributable to IDU has increased from 8.9% during 1985-94 to about 30% during 1997-99[1].

With respect to gender, males and females represent 86.7% and 13.3%, respectively, of the cumulative number of positive HIV test reports with known gender. Between the period 1985-94 and the year 1999, the percentage of positive HIV test reports among females increased from 9.8% to 24.8%[1].

Those who present for HIV testing and test positive are only a proportion of the HIV-infected population. At the end of 1996, the Bureau of HIV/AIDS, STD and TB estimated that of the 40,100 Canadians living with HIV, 15,000 were HIV-infected but unaware of their infection.[2]

Reported AIDS Cases

Since 1995, the delay-adjusted number of AIDS cases reported to LCDC per year has steadily declined (Figure 1). This decrease in the number of AIDS cases may be attributed to a number of factors, such as improved treatment and prophylaxis regimens that delay or prevent the onset of AIDS, an increase in awareness and education of the risk factors that cause AIDS, and reporting delays and under-reporting of AIDS cases. Since 1997, however, the rate of decline in the number of delay-adjusted AIDS cases has slowed and the curve is now leveling off. Reasons for this are not yet clear, but may include issues such as the development of resistance to antiretroviral drugs, whether therapy can prevent

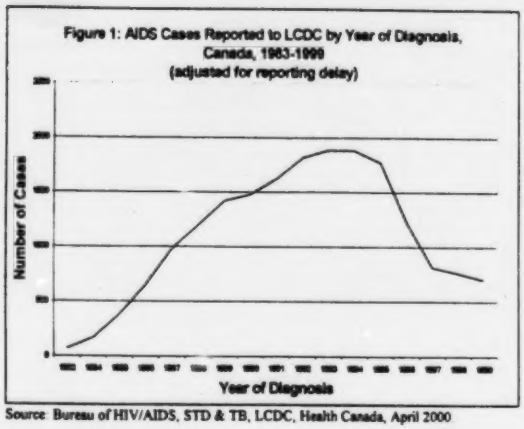


Figure 1: AIDS Cases Reported to LCDC by Year of Diagnosis, Canada, 1983-1999
(adjusted for reporting delay)
Number of Cases
Year of Diagnosis
Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

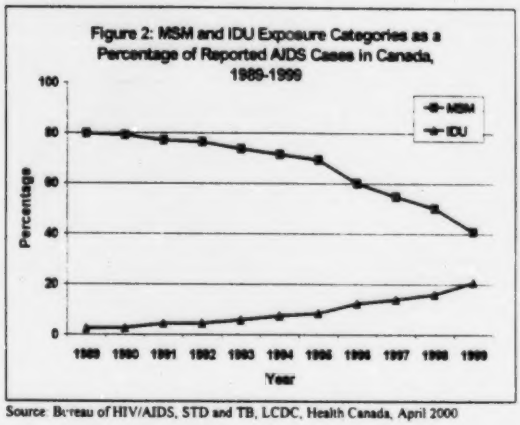


Figure 2: MSM and IDU Exposure Categories as a Percentage of Reported AIDS Cases in Canada, 1989-1999
MSM
IDU
Percentage
Year
Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000

or only postpone the development of AIDS, and the number of individuals who are diagnosed with AIDS without a prior diagnosis of HIV infection.

The age group that consistently shows the highest percentage of reported AIDS cases (over 40% annually) are those in the 30-39 year age group. Due to the prolonged lag time between HIV infection and the onset of AIDS, these individuals were most likely exposed to HIV in their early 20's. Other noteworthy changes have occurred in the 20 to 29 year age group where between 1990 and 1999 the percentage of reported AIDS cases decreased from 19.4% to 7.1%. Persons aged <15, 15-19, 20-29, 40-49 and 50+ represent only 1.2%, 0.3%, 16.4%, 26.9 and 11.2%, respectively, of the cumulative number of reported AIDS cases[1].

The exposure category of men who have sex with men (MSM) still represents the majority of the cumulative adult AIDS cases (73.3%) even though there has been a decline in the number of reported cases over the last ten years. In 1989, MSM accounted for 79.9% of all reported adult cases of AIDS, and by 1999, 40.9% of all adult cases of AIDS were attributed to this exposure category (Figure 2). At the same time, injection drug use (IDU) has increasingly become an important route of transmission of HIV in Canada. Between 1989 and 1999, IDU among all adult cases of AIDS has increased from 2.5% to 20.7%[1].

Proportion of AIDS Cases Among Females Increasing

Females now account for 7.5% of the total cumulative reported AIDS cases up to December 31, 1999, and represent an increasing proportion of AIDS cases diagnosed each year among adults (15 years and over) (Figure 3). The majority of reported AIDS cases in females are in the 30-39 year age group, child-bearing years, and therefore are at risk of passing the virus on to their newborn children. Even though pediatric cases account for only a small percentage of the total reported AIDS cases, it is important to note that 82.7% of cumulative AIDS cases in children (less than 15 years old) were attributed to perinatal transmission.

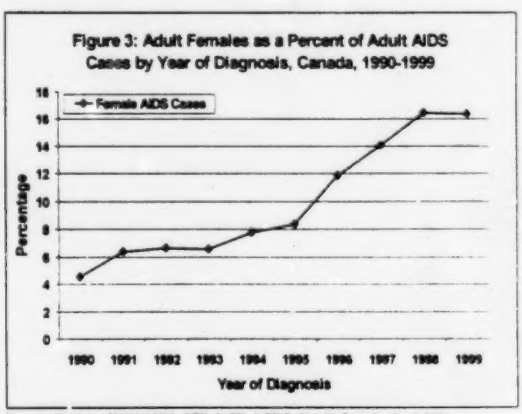


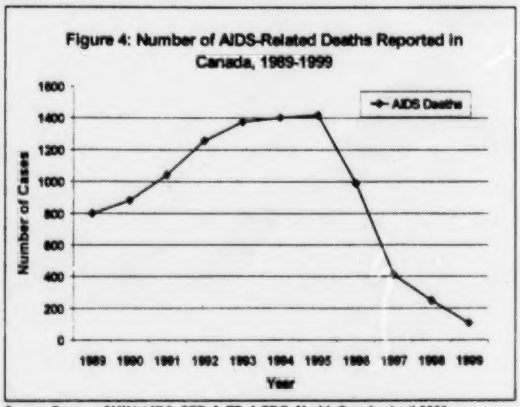
Figure 3: Adult Females as a Percent of Adult AIDS Cases by Year of Diagnosis, Canada, 1990-1999
Female AIDS Cases
Percentage
Year of Diagnosis
Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

Heterosexual contact (origin in an endemic country) and heterosexual contact with a person at risk represents the two main exposure categories among cumulative adult female cases: 26.9% and 36.6%, respectively. However, the injection drug use (IDU) category is of increasing concern as it continues to rise in importance. This exposure category accounted for 31.7% of adult female cases in 1999 compared to 15.5% in 1990.

AIDS Death Reports

Of the total number of AIDS cases reported to LCDC as of December 31, 1999, 69.5% (11,748 cases) are now deceased (Figure 4). The number of reported AIDS deaths peaked at 1,422 in 1995. Since 1995, the number of reported AIDS deaths each year has significantly declined, with a 92.5% drop in reported AIDS deaths in 1999 as compared to 1995.

Information on deaths allows the Division of HIV/AIDS Surveillance to estimate the number of persons living with AIDS and the impact of treatment. However, due to reporting delays and under-reporting for both AIDS cases and deaths among AIDS cases, the actual number of persons living with AIDS is not equivalent to the difference between the total of reported AIDS cases and total AIDS-caused deaths.



Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

Comment

Reported HIV and AIDS surveillance data only represent individuals who come forward for HIV-testing and medical care. Therefore, the full extent of the HIV epidemic cannot be measured when a large segment of the population may be HIV-infected and not yet diagnosed. The data presented in this report suggests that the HIV/AIDS epidemic in Canada continues to evolve and affect different susceptible populations. Further details and discussion of the various trends noted here are presented in the other *Epi Updates* in this series. To better monitor the shifting epidemic, given the fact that improved treatments are available for HIV infection, more accurate and complete HIV data are required to identify populations at risk, new populations being affected, and hard-to-reach populations.

References

1. Health Canada. *HIV and AIDS in Canada. Surveillance Report to December 31, 1999.* Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000.

2. Health Canada. "HIV Testing Among Canadians: 15,000 Current HIV Infections May Not Be Diagnosed," *HIV/AIDS Epi Update*, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

HIV Prevalence and Incidence in Canada: 40,100 Living with HIV Infection and 4,200 New Infections Per Year

Introduction

Estimates of national HIV prevalence and incidence are required to effectively monitor the HIV epidemic at the national level and to help guide and evaluate prevention programs. This report presents national estimates[1] for Canada at the end of 1996 using a technique that combines direct and indirect estimation methods. Note that these estimates are currently being updated by the Bureau of HIV/AIDS, STD and TB for the end of 1999 and these new estimates will be published later in the year 2000.

Methods

For the direct method, estimates of the number of prevalent and incident HIV infections were derived by multiplying prevalence and incidence rates measured in available epidemiologic studies by estimates of population size. Population size estimates were obtained from census and survey data, and from capture-recapture analysis for injection drug users (IDUs). The direct method was carried out in the cities of Montreal, Toronto, Calgary, Edmonton and Vancouver for each of five exposure categories (homosexual/bisexual men (MSM), IDU, MSM-IDU, high-risk heterosexuals, and recipients of blood/clotting factor). Estimates were then extrapolated from these five cities to their respective provinces and to the rest of Canada based on trends in recent HIV and AIDS diagnoses for each exposure category.

An indirect method was also used to calculate prevalence by dividing the cumulative number of persons diagnosed with HIV infection, less cumulative deaths, by the proportion tested for HIV. The number of persons diagnosed with HIV infection was obtained from provincial HIV testing databases and the proportion of each group tested for HIV was obtained from population surveys and epidemiologic studies. For each category, the mean of the direct and indirect estimates was used as the final point estimate and ranges were calculated using statistical simulation techniques.

Prevalence Results

At the end of 1996, an estimated 40,100 Canadians were living with HIV infection (including those living with AIDS). By exposure category, 25,300 (63.1%) of the prevalent 1996 infections were among MSM, 1,700 (4.2%) among MSM-IDU, 7,100 (17.7%) among IDUs, 5,500 (13.7%) among non-IDU heterosexuals, and 500 (1.3%) among recipients of blood or clotting factor (Table 1).

Incidence Results

During 1996, there were an estimated 4,200 new HIV infections in Canada (Table 2). A total of

1,240 (29.5%) of the new infections were among MSM, 290 (6.9%) among MSM-IDU, 1,970 (46.9%) among IDU, and 700 (16.7%) among heterosexuals.

Table 1: Point estimates and ranges (95% confidence interval) for number of prevalent HIV infections in Canada at the end of 1996, by exposure category and gender

	MSM	MSM-IDU	IDU	Hetero	Blood/Clotting	Total
Men and women	25,300	1,700	7,100	5,500	500	40,100
95% CI	22,500-28,100	1,400-2,100	6,000-8,500	4,400-6,900	430-580	37,100-43,300
Women	0	0	2,000	2,500	100	4,600
95% CI			1,600-2,500	1,900-3,200	85-120	4,000-5,300

Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000

Table 2: Point estimates and ranges (95% confidence interval) for number of incident HIV infections in Canada at the end of 1996, by exposure category and gender

	MSM	MSM-IDU	IDU	Hetero	Blood/Clotting	Total
Men and women	1,240	290	1,970	700	0	4,200
95% CI	1,050-1,460	230-370	1,600-2,400	540-910		3,700-4,750
Women	0	0	600	350	0	950
95% CI			460-770	260-475		780-1,150

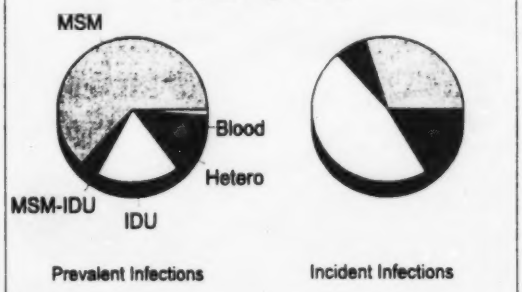
Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000

Trends in Exposure Category and Gender among New Infections

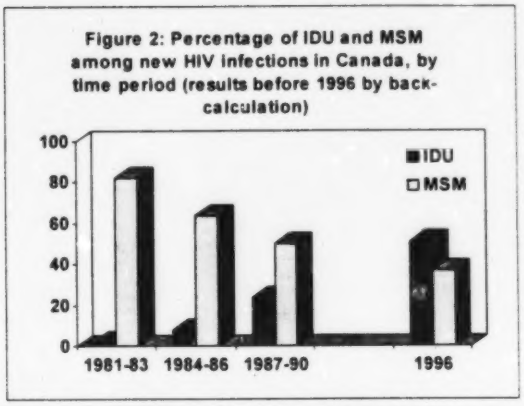
Figure 1 shows the differences in exposure category distribution between prevalent infections (those living with HIV infection, many of whom were infected years ago) and incident infections (those newly infected in 1996). There is a clear shift from the predominance of MSM among older, prevalent infections to the predominance of IDU among new incident infections.

A clearer illustration of this shift in the Canadian HIV epidemic is shown in Figure 2 which depicts the proportion of MSM and IDU among new infections for different time periods. Since the beginning of the HIV epidemic in Canada, there has been a steady decline in the proportion of MSM among new infections, from over 80% during 1981-83 to 29.5% in 1996. Recently, there has been a sharp increase in the proportion of IDU among new infections: from less than 10% before 1986 to 24 % in 1987-90 and to 46.9% in 1996.

Figure 1: Exposure category distributions for prevalent versus incident HIV infections, Canada, 1996 (see text for perecntage values)

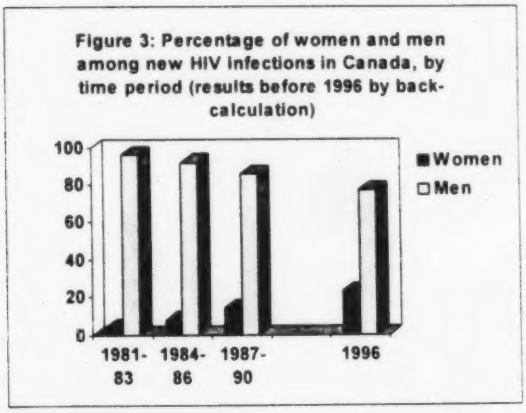


Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000



Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

There were an estimated 4,600 women living with HIV infection at the end of 1996 and women were estimated to comprise 22.6% of new HIV infections in Canada in 1996, an increase from less than 10% before 1986 and 14% in 1987-90 (Figure 3).



Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000

Comment

The estimated prevalence of 40,100 at the end of 1996 compares to a previous estimate of 32,000-36,000 at the end of 1994. The estimated incidence of 4,200 in 1996 is lower than the estimated peak in annual HIV incidence of about 5,000-6,000 that occurred in the mid-1980s (estimated by back-calculation), but is higher than a previous estimate of 2,500-3,000 per year for the period 1989-94. The majority of this recent increase in HIV infections appears to be occurring among IDUs who now comprise nearly half of all new infections. However, MSM still comprise a significant proportion of new infections and available data also suggest increasing HIV infections among non-IDU heterosexuals (especially women).

This combined procedure makes maximum use of a wide variety of surveillance and research data to estimate HIV prevalence and incidence at the national level. The resulting estimates are necessarily somewhat imprecise, especially for incidence, but the degree of certainty is improved by using different methods and combining them in a type of "triangulation" procedure. Advantages of this procedure are that it is flexible, can readily incorporate new data and serves to highlight gaps in existing knowledge.

The estimates of national HIV prevalence and incidence obtained by this procedure of combined direct and indirect methods clearly illustrates the changing face of the HIV epidemic in Canada and the increasing urgency of the situation among IDU. The results are also useful for planning and evaluation purposes and in Canada have demonstrated the need for continued and improved HIV prevention and care program.

References

1. Archibald CP, Remis RS, Farley J, Sutherland D. *Estimating HIV prevalence and incidence at the national level combining direct and indirect methods with Monte-Carlo simulation.* XI International Conference on AIDS, Geneva, Switzerland, June-July 1998 (Abstract 43475).

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

HIV Testing Among Canadians: 15,000 Current HIV Infections May Not Be Diagnosed

Introduction

This *Epi Update* summarizes available data on the characteristics of persons tested for HIV in Canada and presents our estimate of 15,000 Canadians who were HIV-infected but unaware of their infection at the end of 1996. Note that the Bureau of HIV/AIDS, STD and TB is currently developing a new set of estimates for the end of 1999 and these will be available later in the year 2000.

Since HIV testing programs became available in 1985, Canadians have been gaining knowledge of their HIV status. Access to HIV testing services has been either through coded or confidential testing at a doctor's office or clinic, or through anonymous testing sites. Knowledge of whether or not one is HIV positive can be useful for several reasons. If the person is found to be HIV infected, consideration can be given to starting antiretroviral therapy. In the case of pregnant women, treatment can reduce the chances that the infant will be infected (from about 25% to 8%)[1]. As well, counselling received at the time of HIV testing can provide information on how to reduce the risk of HIV infection to the individual if HIV negative, and to others if the individual is HIV positive.

From 1985, when testing was instituted, to December 31, 1996, an estimated 39,000 people in Canada had tested positive for HIV[2]. These HIV-positive test data are based on non-nominal, confidential HIV testing information provided by all provinces and territories in Canada, with duplicate tests for the same individual removed to the extent possible. The removal of duplicates is necessary to accurately reflect the number of annual new HIV diagnoses. Duplicate removal rates vary by year, province and type of data (nominal, non-nominal or anonymous), so comparison between these categories is problematic. It is important to note, however, that in most provinces the ability to remove duplicates has improved significantly since 1995. Additionally, data on HIV-positive tests only represent the tested population and do not represent all persons who have been infected with HIV. Further details on the analysis of national HIV-positive test data are given in reference number 2 and in the *Epi Update* entitled "AIDS and HIV in Canada".

Characteristics of Persons Tested for HIV

A Canada-wide survey conducted in January 1997 found that 18.6% of men aged 15 years and older and 16.2% of women aged 15 years and older had been tested for HIV (excluding tests for blood donation and insurance purposes)[3]. Of those tested, 39% had been tested in the year prior to the survey, 57% in the prior two years, and 43% had their most recent test more than two years prior to the

survey. A 1996 survey[4] found that, taking into account ancillary testing such as donating blood or being tested for life-insurance purposes, 41% of men and 31% of women in Canada had ever been tested for HIV.

National surveys of the general population suggest that those who report risk factors are more likely to be tested:

- Among those who had opposite-sex partners, those with two or more partners in the last year were more likely to be tested than those with one partner (50.5% vs 17.4%). Of those who reported having had an STD in the past five years, 58% had been tested compared to 17.4% of those who did not report an STD[3].

- For men, testing was higher among those who had sexual intercourse with another man (71%), used injection drugs (62%), received blood or clotting factor between 1978 and 1985 (27%), or had a partner with a risk factor (IDU, having received blood or clotting factor between 1978 and 1985, from country endemic for HIV) (30%)[4]. For women, testing was higher among those who had received blood or clotting factor between 1978 and 1985 (32%), had a high-risk partner (38%), or had sexual intercourse with a man since 1978 (17%)[4].

- Testing is highest among individuals aged 25 to 34 years[3,4]. Even after taking into account all other risk factors, those aged ≥45 years are still less likely to be tested than are those <45 years[3,4].

- Although those reporting risk factors such as IDU, multiple partners, or MSM are more likely to be tested, a substantial proportion of those reporting risk factors have not been tested recently, or have not been tested at all. For example, among those who report more than one partner in the last year and not using condoms consistently, 53% of men and 38% of women have never been tested.

Estimated Number of HIV-Infected Persons Who Are Unaware of Their Infection

As noted in the Introduction, a total of approximately 39,000 Canadians had tested positive for HIV up to the end of 1996. An estimated 13,000-15,000 individuals of this total had died of AIDS by the end of 1996 (adjusted for reporting delay and under-reporting). Therefore, approximately 24,000-26,000 individuals of this 39,000 total were still alive at the end of 1996.

The Bureau of HIV/AIDS and STD has previously estimated that at the end of 1996, approximately 40,000 Canadians (range 37,000-43,000)[5] were living with HIV infection (including those living with AIDS) (also see *Epi Update* entitled "HIV prevalence and incidence in Canada"). This number includes both those who are aware of their infection (by having tested positive for HIV) and those who are not. The difference between the number alive and HIV-infected (40,000) and the number alive and tested positive for HIV (24,000-26,000) represents an estimate of the number of persons alive and unaware of their infection (not tested positive for HIV). This difference is approximately 15,000 (range 12,000-18,000) or about 30-40% of the estimated 40,000 Canadians (range 37,000-43,000) living with HIV infection at the end of 1996.

Therefore, at the end of 1996, there were an estimated 15,000 HIV-infected persons living in Canada who were not aware of their HIV infection.

Comment

Canadians with risk factors for HIV infection are more likely to have been tested for HIV than those without such risk factors, but there still remains a significant proportion of persons with risk factors who have never been tested for HIV. More needs to be learned about those who are at risk for HIVand yet have not been tested. Furthermore, at the end of 1996, there was an estimated 15,000 HIV-infected Canadians who were unaware of their

infection. Given these data, and the fact that new treatments are available for HIV infection, it is more important than ever that HIV testing be accessible for all Canadians.

References

1. Connor EM, Sperling RS, Gelber R, et al. (1995). *Reduction of maternal-infant transmission of human immunodeficiency virus type 1 with zidovudine treatment.* Pediatric AIDS Clinical Trials Group Protocol 076 Study Group. New England Journal of Medicine, 331(18), 1173-1180.

2. Health Canada. *HIV and AIDS in Canada. Surveillance Report to June 30, 1998.* Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, November 1998.

3. Houston SM, Archibald CP, Sutherland D. *Sexual risk behaviours are associated with HIV testing in the Canadian general population.* Can J Inf Dis 1998, 9 (Suppl A): 39A, #239P. And unpublished data from: Canada Health Monitor survey, January 1997, Division of HIV Epidemiology, LCDC, Health Canada.

4. Houston SM, Archibald CP, Strike C, Sutherland D. *Factors associated with HIV testing among Canadians: Results of a population-based survey.* International Journal of STD and AIDS 1998; 9:341-346.

5. Archibald CP, Remis RS, Farley J, Sutherland D. *Estimating HIV prevalence and incidence at the national level: combining direct and indirect methods with Monte-Carlo simulation.* XII International Conference on AIDS, Geneva, June-July 1998 (Abstract 43475).

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

HIV Infection Reporting in Canada

Introduction

As highlighted in the most recent Canadian HIV and AIDS surveillance report, the total number of AIDS cases and the total number of positive HIV tests reported in Canada since the beginning of the epidemic to December 31, 1999 are 16,913 and 45,534, respectively.[1] These numbers give some indication of the magnitude of the HIV/AIDS epidemic in Canada. However, HIV and AIDS surveillance data do not reflect the full extent of the problem as these numbers do not include HIV-infected persons still unaware of their infection. Details on the characteristics of persons tested for HIV are outlined in the April 2000 *Epi Update* entitled "HIV Testing Among Canadians: 15,000 Current HIV Infections May Not Be Diagnosed."[2]

HIV testing patterns within the general population, along with the profile of people being tested, are important for designing and targeting intervention programmes[3], as well as, for developing a context for HIV/AIDS surveillance data. Therefore, it may be useful to: 1) establish a national inventory of where HIV testing is available; 2) describe where HIV infection is reportable and by whom; and 3) update the status of anonymous HIV testing (AHT) within each province/territory. These issues were addressed in a survey on HIV testing conducted in early 1998 by the Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB. The survey findings on HIV testing in Canada are presented in this *Epi Update*.

Survey Methodology

A survey on HIV reportability, HIV testing, and anonymous HIV testing was distributed to each provincial and territorial representative responsible for HIV/AIDS surveillance. Respondents were then contacted by telephone to follow-up and ensure that the survey was completed and returned. Results of the questionnaire are presented below.

Survey Results: HIV Infection Reportable in 8 Provinces and 2 Territories [4]

A summary of the information regarding HIV infection reportability, as well as the types of HIV testing services offered throughout Canada, is summarized in Table 1.

- HIV infection is legally reportable in all provinces and territories except British Columbia and Quebec (and these two provinces are considering making it reportable). Most of these provinces and territories had HIV reportability legislation in place by the mid- to late-1980s.

- HIV reportability is governed by legislation enacted by each province or territory, and requires that 'nominal/name-based' or 'non-nominal/non-identifying' information about an individual who tests positive for HIV be forwarded to provincial/territorial public health officials.

- In most testing situations, laboratories and physicians are responsible for reporting HIV

infection to the province or territory.

- The type of HIV case reporting (i.e. nominal/name-based or non-nominal/non-identifying) varies across Canada (Table 1).

Table 1: HIV Testing and HIV Reporting by Province/Territory as of January 31, 1999.

Prov Terr	Type of HIV Testing	HIV Infection Reportable[1]	HIV Infection Reportable By:	Level of Reporting to the Prov/Terr
B.C.	N, NN, A	No	N/A	N/A
YK	N, NN	Yes (1995)	P, RN	N
NW	N, NN	Yes (1988)	L, P, RN	N
Alta.	N, NN, A	Yes (1998)	L, P	NN
Sask	N, NN, A	Yes (1988)	L, P	NN
Man.	NN	Yes (1987)	L, P	NN
Ont.	N, NN, A	Yes (1985)	L, P	N, NN[2]
Que.	N, NN, A	No	N/A	N/A
N.B.	N, NN, A	Yes (1985)	L, P, RN	NN
N.S.	N, NN, A	Yes (1985)	L, P	N
P.E.I	N, NN	Yes (1988)	P, RN	N, NN
Nfld.	N, NN, A	Yes (1987)	L, P	N

Source: Anonymous HIV Testing (AHT) Survey. Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, 1998 (unpublished data)

A = Anonymous
L = Lab
N = Nominal/Name-Based
N/A = Not Applicable
NN = Non-Nominal/Non-Identifying
P = Physician
RN = Nurse

[1] Refers to legislation governing the type of HIV infection reporting to provincial/territorial health officials and the year it came into effect.

[2] In Ontario, HIV positive data from AHT are reported non-nominally at the provincial level.

Nominal/Name-Based and Non-Nominal/ Non-Identifying HIV Testing

- Nominal/name-based HIV testing is available in all provinces and territories except Manitoba. This service is available by request through all physicians in Canada.

- Non-nominal/non-identifying HIV testing is available in all provinces and territories. Non-nominal HIV testing can be accessed through physicians, community or public health clinics, STD clinics, sexual health units or nursing stations depending on the province/territory.

Anonymous HIV Testing

- Anonymous HIV testing (AHT) is available in 8 provinces. AHT is offered through community or public health clinics, sexual health centres and some physicians.

Table 2: Status of Anonymous HIV Testing by Province/Territory as of January 31, 1999.

Prov Terr	AHT Since[1]	AHT Sites	AHT Data Reported[2]	Counselling Services Available
B.C.	1985	Any Physician	No	Yes
YK	N/A	None	N/A	N/A
NWT	N/A	None	N/A	N/A
Alta.	1992	3	Yes	Yes
Sask.	1993	3	Yes	Yes
Man.	N/A	None	N/A	N/A
Ont.	1992	34	Yes	Yes
Que	1987	60+	No	Yes
N.B.	1998[3]	7	N/A	Yes
N.S.	1994	1	Yes	Yes
P.E.I.	N/A	None	N/A	N/A
Nfld.	**	6	Yes[4]	Yes[4]

Source: Anonymous HIV Testing (AHT) Survey. Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, 1998 (unpublished data)

** = AHT is available upon request, but are not the official guidelines for the province/territory.

[1] Refers to the availability of AHT in the respective province/territory, and the year in which AHT was implemented.

[2] Refers to whether or not HIV positive test data from AHT is reported to the Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

[3] AHT in New Brunswick is established as a one year pilot project.

[4] If someone tests positive for HIV through AHT, that individual then becomes part of the nominal/name-based system, where counselling, follow-up care and HIV data reporting are all done nominally.

- Anonymous testing can encourage more people to come forward for HIV testing and counselling since this practice offers the highest degree of confidentiality (i.e. personal identifiers are not requested or recorded).[5]

- In its first year of operation, AHT sites in Ontario tested approximately 5% of the total tested population, and attracted individuals at high risk of HIV infection, especially men who have sex with men.[6]

- Several studies in the United States have shown that AHT programs encourage people to be tested for HIV, especially those at high-risk or who would not volunteer for testing under nominal/name-based or non-nominal/non-identifying circumstances.[7,8,9]

- Additional information on AHT is highlighted in the *Epi Update* entitled "Anonymous HIV Testing in Canada".[10]

Comment

All provinces and territories in Canada offer at least one form of HIV testing: nominal/name-based, non-nominal/non-identifying and/or anonymous testing. Each province and territory, however, has a different practice for HIV infection reporting. HIV infection is legally reportable in eight provinces and two territories (Table 2). Although, British Columbia and Quebec do not have legislation governing HIV infection reporting, these provinces are still able to collect some data about HIV infection from provincial HIV testing laboratories.

At present, nominal/name-based and non-nominal/non-identifying HIV testing is widely available in Canada. Anonymous HIV testing is available in only eight provinces. Increased availability and accessibility to different types of HIV testing may allow individuals to choose the testing and counselling environment in which they feel most comfortable, encourage more people to be tested, and facilitate the targeting of intervention and treatment programs.[11]

For more information on HIV testing, please contact your provincial or territorial public health department.

References

1. Health Canada. *HIV and AIDS in Canada: Surveillance Report to December 31, 1999.* Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, April 2000.

2. Health Canada. "HIV Testing Among Canadians:15,000 Current HIV Infections May Not Be Diagnosed," *HIV/AIDS Epi Update.* Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, April 2000.

3. Houston S, Archibald CP, Strike C, Sutherland D. *Factors associated with HIV testing among Canadians: results of a population-based survey.* International Journal of STD and AIDS 1998; 9:341-346.

4. Health Canada. *Anonymous HIV Testing (AHT) Survey.* Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, March 1998 (unpublished data).

5. Jürgens R, Palles M. *HIV Testing and Confidentiality: A Discussion Paper.* Pp. 52-69. Canadian HIV/AIDS Legal Network and the Canadian AIDS Society, 1997.

6. Browne J, Major C, Galli R, Fearon M, Chang CH. *HIV anonymous testing--does it make a difference?* (Abstract no. PO-C28-3249). IXth International Conference on AIDS. Berlin, 6-11 June, 1993; 9(2): 758.

7. Keagles SM, Catania JA, Coates TJ, Pollack LM, Lo B. *Many people who seek anonymous HIV-antibody testing would avoid it under other circumstances.* AIDS 1990; 4(6): 585-588.

8. Hoxworth T, Hoffman R, Cohn D, Davidson A. *Anonymous HIV Testing: Does It Attract Clients Who Would Not Seek Confidential Testing?* AIDS & Public Policy Journal 1994; 9(4): 182-188.

9. Hertz-Picciotto I, Lee LW, Hoyo C. *HIV Test-Seeking Before and After the Restriction of Anonymous Testing in North Carolina.* American Journal of Public Health 1996; 86(10): 1446-1450.

10. Health Canada. "Anonymous HIV Testing in Canada," *HIV/AIDS Epi Update*. Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, April 2000.

11. Hong BA, Berger SG. *Characteristics of individuals using different HIV/AIDS counseling and testing programs*. AIDS 1994; 8: 259-262.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

Positive HIV Test Reports in Canada

Introduction

In 1999, 2,231 individuals were newly-diagnosed with HIV and reported to the Laboratory Centre for Disease Control (LCDC), Health Canada.[1]

This *Epi Update* summarizes available data on diagnosed HIV infections in Canada and highlights trends in reported HIV cases.

HIV Positive Test Reports

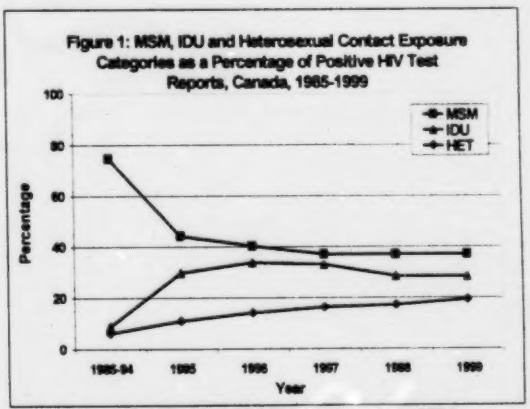
The number of newly-diagnosed positive HIV tests has been slowly declining since 1995 when 2,989 positive tests were reported. The 2,231 new cases in 1999 compares to 2,783, 2,537, and 2,330 in 1996, 1997 and 1998, respectively.[1]

Factors such as who comes forward for testing (testing patterns), reporting delays and under-reporting of positive HIV tests may influence this observed decline.

Trends in Exposure Category among New Infections

The HIV epidemic in Canada has changed from the early epidemic that primarily affected men who have sex with men (MSM) to the current epidemic that primarily affects injection drug users (IDU), MSM and to some extent, heterosexuals (HET) (Figure 1).

In the reporting period 1985 to 1994, MSM accounted for 75% of newly-diagnosed positive HIV tests reported to LCDC. In contrast, in 1999, MSM accounted for 37% of positive HIV test reports.



Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

For reporting purposes, heterosexual contact is defined to be the sum of two exposure categories; persons with no other reported risk factor and who report heterosexual contact with a person who is either HIV-infected or who is at increased risk for HIV infection, and persons with no other reported risk factor who were born in a country in which the predominant means of HIV transmission is heterosexual contact. Please see *HIV and AIDS in Canada: Surveillance Report to December 31, 1999*[1] for details.

In the 1985 to 1994 reporting period, heterosexual sexual contact accounted for 6.2% of reported positive HIV test reports. In comparison, heterosexual contact accounted for 19.4% of positive HIV test reports in 1999.

An exposure category that has seen annual increases in the proportion of newly-diagnosed cases is No Identified Risk-Heterosexual (NIR-HET). This exposure category encompasses those individuals for whom heterosexual contact is the only risk factor reported and nothing is known about the extent of HIV risk for the heterosexual partner. NIR-HET accounted for 1.3% of positive HIV test reports amongst adults in the period 1985 to 1994. This proportion grew to 5.4% in 1997 and 9.3% in 1999.

Trends in Gender among New Positive Tests

Of the 45,534 cumulative number of positive HIV test reports reported, females represent 13.3% (5,288/39,778) of positive tests with known gender.[1]

In 1995, among those with known gender, males accounted for 80.5% (2,191/2,721) of new positive HIV diagnoses, while females accounted for 19.5%. This compares to 75.2% (1,643/2,186) among men and 24.8% among women in 1999.

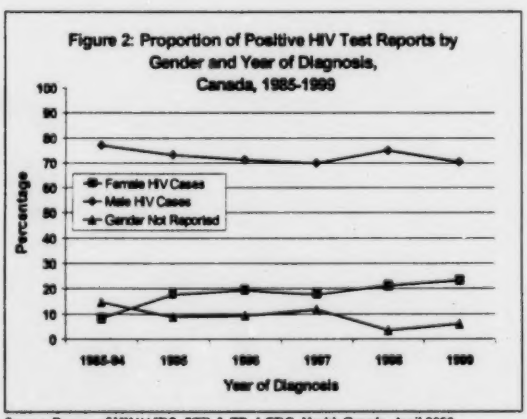
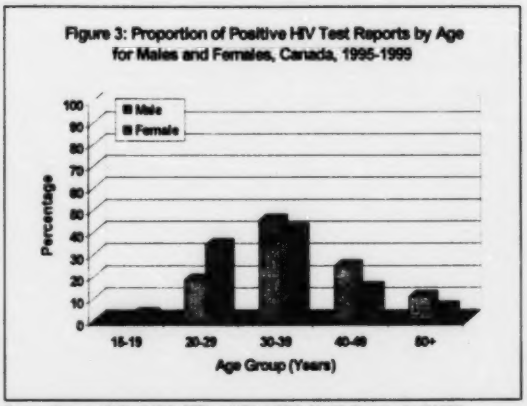


Figure 2: Proportion of Positive HIV Test Reports by Gender and Year of Diagnosis, Canada, 1985-1999
Percentage
Female HIV Cases
Male HIV Cases
Gender Not Reported
Year of Diagnosis

Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

Trends in Age among New Positive Tests

Caution should be exercised in interpreting trends of age at HIV diagnosis, because unlike gender and exposure category, age at diagnosis is temporal in nature. Since in many cases, age at diagnosis is not the same as age at infection, it is difficult to make inferences regarding age at infection based on age at diagnosis.



Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000

In women, the age at first positive HIV test is primarily between 20-29 and 30-39 years. Among reported positive HIV tests in men, we find that the age at first positive test is mainly between 30-39 years.

Comment

Positive HIV test report data suggest that the HIV epidemic is moving into susceptible segments of the population. Increases in the proportions of positive tests among women, and among the IDU and heterosexual exposure categories are indicative of these changes.

Although those who present for HIV testing and test positive are only a proportion of the HIV-infected population, it is of value to observe trends in this population of newly-determined HIV-infected individuals to assist in examining epidemic dynamics, to contribute to estimating HIV incidence and prevalence, and to assist in evaluating and guiding prevention programs and resource allocation policies.

Since HIV test report data only represent individuals who come forward for HIV testing, the full extent of the HIV epidemic cannot be measured when a segment of the population may be HIV-infected and not yet diagnosed. It is estimated that, as of 1996, 15,000 Canadians were infected with HIV but were unaware of their infection.[2]

Other specialized tools, such as targeted epidemiological studies, are used to estimate the impact of HIV upon portions of the population that standard surveillance cannot reach. Synthesizing aspects of positive HIV test surveillance and research studies will lead to a more complete picture of the HIV epidemics in Canada.

References

1. Health Canada. *HIV and AIDS in Canada: Surveillance Report to December 31, 1999.* Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS STD and TB, LCDC, HPB, Health Canada, April 2000.

2. Health Canada. "HIV Testing Among Canadians: 15,000 Current HIV Infections May Not Be Diagnosed," *HIV/AIDS Epi Update*, Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, April 2000.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

HIV and AIDS Among Youth in Canada

Introduction

Youth ages 10 to 24 years are of particular importance with respect to HIV/AIDS. Not only since they are at risk for infection, but also it is during this period of life when many behaviour patterns are established that will affect their risk of HIV infection throughout their adult years. This report updates the current information on the status of HIV and AIDS among Canadian youth and especially highlights data on HIV-associated risk behaviours among this population.

AIDS Data[1]

- As of December 31, 1999, a total of 16,913 AIDS cases had been reported to the Laboratory Centre for Disease Control (LCDC). Of these, 600 (3.5%) were diagnosed among youth ages 10 to 24 years. Given the median length of time between HIV infection and the onset of AIDS (ten years or more), many individuals in older age groups would have been infected with HIV during their youth.

- As seen in Table 1, mode of infection varied by age. Exposure to infected blood or blood products accounted for most reported AIDS cases among individuals ages 10 to 19 years. In contrast, exposure categories among 20 to 24 year olds were more similar to those reported among adults with AIDS (sexual transmission the main route of exposure).

Table 1: Number of AIDS Cases with Associated Exposure Categories (%) for Individuals 10 to 24 Years of Age in Canada, Diagnosed up to December 31, 1999.

Category	10 -19 years of age	20-24 years of age
Number of Cases	83	517
Percentage of all reported AIDS cases	0.5%	3%
Associated Exposure Categories[1]	70% Blood & Blood Products 12% MSM 10% Heterosexual Contact/Endemic 4% IDU 4% MSM/IDU	8% Blood & Blood Products 51% MSM 18% Heterosexual Contact/Endemic 13% IDU 10% MSM/IDU

Source: HIV and AIDS in Canada: Surveillance Report to Dec. 31, 1999. Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000.
IDU = Intravenous Drug Use MSM = Men who have sex with men
[1]Percentages based on the total number of cases minus those reports for which exposure category was unknown or "not identified."

HIV Testing Data[1]

- As of December 31, 1999, a total of 45,534 positive HIV tests had been reported to LCDC. Among those with age group reported, 597 (1.5%) were among youth ages 15 to 19 years, and 11,398 (27.9%) were among individuals ages 20 to 29 years (HIV data received from provinces do not currently allow separation of the 20 to 24 year age group.).

As with reported AIDS cases, the mode of infection varied by age among youth. Table 2 shows the distribution of exposure categories for HIV positive test reports received between January 1, 1998 and December 31, 1999. Heterosexual contact, MSM, and IDU accounted for most cases in the 10 to 19 year age group, while among the 20 to 29 year age group, the IDU exposure category was of equal importance to MSM.

Table 2: Distribution of Exposure Categories Among Positive HIV Tests Reported between January 1, 1998 and December 31, 1999 for Individuals Ages 10 to 29 Years in Canada.

Category	10-19 years of age	20-29 years of age
Associated Exposure Categories[1]	37% Heterosexual Contact/Endemic 30% MSM 30% IDU 3% Blood & Blood Products	36% MSM 36% IDU 24% Heterosexual Contact/Endemic 3% MSM/IDU 1% Blood & Blood Products

Source: HIV and AIDS in Canada: Surveillance Report to December 31, 1999. Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000

IDU = Intravenous Drug Use MSM = Men who have sex with men

[1]Percentages based on the total number of cases minus those reports for which exposure category was unknown, "other," or "not identified."

- A cumulative total of 664 positive HIV test reports had been received for individuals ages < 15 years by the end of 1999. In this group, perinatal transmission and exposure to infected blood and blood products accounted for over 90% of cases (HIV data received from provinces do not allow separation of the ten to 14 year age group before 1998.).

HIV Prevalence and Incidence Data Show Highest Risk is Among Street Youth and Youth Who Inject Illicit Drugs

HIV prevalence and incidence information, in conjunction with HIV/AIDS surveillance data, are more useful than are surveillance data alone for depicting the current magnitude of the HIV epidemic in various subgroups of the general population.[2] To date, only a limited number of studies have examined HIV prevalence or incidence among Canadian youth. Data from these investigations suggest that street-involved youth and youth who inject drugs are particularly affected by HIV infection.

- Among Winnipeg injection drug users, HIV prevalence was reported as 10.5% among those ages 20 to 24 years.[3]

- In the SurvIDU Network Study (1995-98)[4], the prevalence of HIV among male and female drug injectors ages 20 to 24 years was 4.0% and 2.4% respectively.

- A prevalence rate of 0.25% was observed among young offenders ages 12 to 19 years in British Columbia (1995), many of whom reported a history of injection drug use.[5]

- Studies of street youth ages 14 to 24 years in Montreal (1995-98)[6] and Toronto (1991)[7] found HIV prevalence rates of 1.4% and 2.3% respectively. HIV incidence among Montreal street youth was estimated at 0.55 infections per 100 youth during 1995-98.[6]

- In a survey of attendees of STD clinics in Ontario (1992), an HIV prevalence rate of 0.1% was found among 15 to 19 year old males.[8] The prevalence rate among females in this age group was 0.04%.

- Sentinel hospital surveillance of HIV infection in Quebec (1989-94),[9] a study of women seeking prenatal care in British Columbia (1989-94),[10] and a survey of youth from across Canada involved in an international exchange program (1986-96)[11] reported prevalence rates of 0.04% to 0.08% among young people ages 14 to 25 years.

Risk Behaviour Data Among Canadian Youth Still Show the Potential for Increased HIV Transmission

Youth, particularly those who are street-involved, begin to have sexual intercourse at a relatively early age.

- For youth interviewed by school-based and general population surveys, the median age at

first intercourse (AFI) ranges from 14 to 16 years.[12] For street youth and surveys of other higher risk populations (e.g. STD clinic attendees), the median AFI ranges from 12 to 15 years of age.[12]

A substantial proportion of young people report having multiple sexual partners in the past year.

- In a 1996 Nova Scotia study of students in grades 10 and 12, 20% of boys and 17% of girls had had three or more sex partners in the year prior to being interviewed.[13]

- In the 1994 National Population Health Survey (NPHS), 21% of males and 13% of females ages 15 to 19 years reported having at least two sex partners in the last year.[14] Among individuals ages 20 to 24 years, 27% of males compared with 16% of females reported having at least two partners in this time frame. When the analysis was restricted to only those who were sexually active, 47% of males and 32% of females ages 15 to 19 years reported at least two sex partners in the year prior. Among sexually active 20 to 24 year olds, the corresponding percentages were 35% and 20%.[14]

- In a 1993 survey of Ottawa street youth ages 15 to 20 years, 21% of boys and 26% of girls who were sexually active had had four or more partners in the past year.[15]

The results of school- and population-based surveys suggest that many Canadian youth are having unprotected sexual intercourse. In particular, not using condoms appears to be more common among young women than it is among young men.

- In a 1996 Nova Scotia survey, among sexually active students, 15% of grade 10 and 25% of grade 12 students reported that they never used condoms.[13]

- Among sexually active 15 to 19 year olds, in the 1994 NPHS (excluding subjects who had a single sex partner and who were married, common-law, divorced, or widowed), 51% of females and 29% of males reported never or only sometimes using a condom in the past year.[14] The corresponding percentages among those ages 20 to 24 years were 53% and 44%.[14]

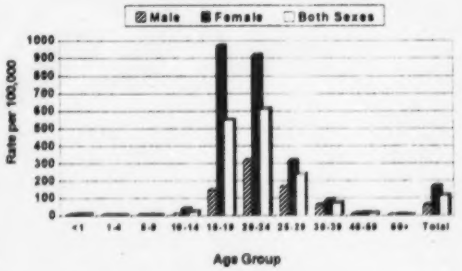
- In a 1993 survey of Ottawa street youth, only 27% of boys and 8% of girls ages 15 to 20 years reported that they had always used condoms in the last year.[15]

The extent of inconsistent condom use among youth is further captured in pregnancy rates among young women ages 15 to 19 years and in rates of chlamydia and gonorrhea among those ages 15 to 24 years.

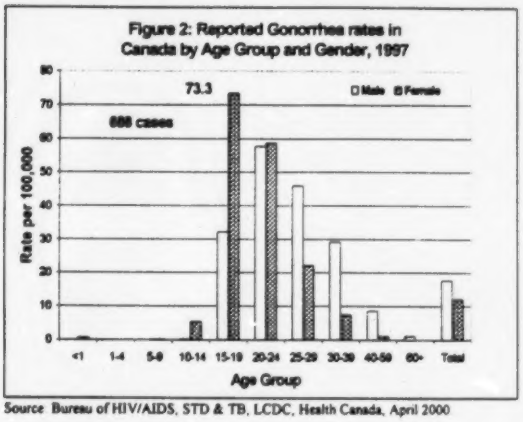
- The pregnancy rate in young women ages 15 to 19 years in Canada increased from 41.1/1000 in 1987 to 48.8/1000 in 1994. This latter rate represents a total of 46,800 pregnancies in 1994 in this age group.[16]

- Figures 1 and 2 show that in1997, 69% of all reported cases of chlamydia and almost 50% of all reported cases of gonorrhea in Canada occurred among individuals ages15 to 24 years. In that year, the reported incidence of chlamydia was highest among females ages 15 to 19 years (971.6 /100,000). The reported incidence of gonorrhea was also highest among this group of young women (73.3 /100,000)[17, 18].

Figure 1:Reported Genital Chlamydia Rates in Canada by Age Group and Sex, 1997



Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000



Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

Research reveals that levels of injection drug use and injection risk behaviours among youth require ongoing assessment.

- A recent study of street youth in Montreal[6] found that 46% had injected drugs in their lifetime. Of these, 52% had borrowed a used needle to inject themselves on at least one occasion. Also alarming was the incidence of initiation of injection drug use in this cohort of street youth, estimated to be 10.3 per 100 person-years.[19,20]

- In the ongoing Ontario Student Drug Use Survey, the proportion of sampled students reporting needle sharing in the previous year has remained below 0.5%. Although small, this percentage represents approximately 2,000 Ontario students in 1997 who were potentially exposed to HIV because they injected drugs with a needle that had been used by someone else.[21]

Is it Time to Take the Test? - HIV Testing Behaviour Among Youth

Recent data suggest that a fairly large proportion of youth have sought HIV testing.

- According to a 1997 survey across Canada[12], 8.2% of boys and 19.6% of girls ages 15 to 19 years had ever been tested for HIV. A 1995 survey showed that 18% of women and 22% of men ages 15 to 24 years had been tested for HIV either through blood donation, insurance testing, or voluntary testing.[22]

Comment

The issue of HIV/AIDS is affecting many subgroups of the Canadian population, including youth; and in particular, street youth and youth who inject illicit drugs. Although the limited data that are available suggest that HIV prevalence is currently low among youth who do not inject drugs or who are not street-involved, sexual behavior and STD data clearly indicate that the potential exists for the spread of HIV among Canadian youth. Better epidemiological and behavioural data are needed to fully assess the risk of transmission among youth and to guide and evaluate prevention and care programs. Youth-oriented programs that combine HIV prevention with the prevention of other STDs, teenage pregnancy, and substance use are critical for the well-being of youth and also for the development of healthy behaviours among youth that will further enhance their health as adults.

References

1. Health Canada. *HIV and AIDS in Canada, Surveillance Report to December 31, 1999.* Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS,STD & TB, LCDC, HPB, Health Canada, April 2000.

2. Lindegren ML, Hanson C, Miller K, Byers RH, Onorato I. *Epidemiology of Human Immunodeficiency Virus Infection in Adolescents, United States.* Pediatric Infectious Disease Journal 1994; 13: 525-535.

3. Elliott L, Blanchard J, Dinneer KI, Dadwood MR, Beaudoin C et al. *The Winnipeg Injection Drug Epidemiology (WIDE) Study.* {Abstract 314}. Canadian Journal of Infectious Diseases 1999; (10): 46B.

4. Alary M, Hankins C, Parent R, Noel L, Claessebs C, Blanchette C, et al. *Le RESEAU SurvUDI: Quatre années de surveillance du VIH chez les utilisateurs de drogues injectables.* Report to LCDC, June 1999.

5. Rothon D, Strathdee SA, Cook D, Cornelisse PGA. *Determinants of HIV-Related High Risk Behaviours among Young Offenders: A Window of Opportunity.* Canadian Journal of Public Health 1997; 88(1):14-17.

6. Roy E, Hayley N, Boivin JF, Frappier JY, Classens C, Lemire N, et al. *Etude de cohort sur l'infection as VIH chez les jeunes de la rue de Montreal.* Final report to LCDC, March 1998 and Roy E (personal communication, April 1999).

7. Read S, DeMatteo D, Bock B, Coates R, Goldberg E, King S, et al. *HIV Seroprevalence in Toronto Street Youth.* 2nd Annual Canadian Conference on HIV/AIDS Research, Vancouver, May 1992 {Abstract 57}.

8. Fearon M, Major C, Notenboom R, Galli R, Prytula A, Demshar H, et al. *HIV Prevalence in Syphilis Submissions from Individuals at Risk for Sexually Transmitted Diseases.* 2nd Annual Canadian Conference on HIV/AIDS Research, Vancouver, May 1992 {Abstract 58}.

9. Alary M, Joly JR, Parent R, Fauvel M, Dionne M. *Sentinel Hospital Surveillance of HIV Infection in Quebec.* Canadian Medical Association Journal 1994; 151(7): 975-80.

10. Pi D, Ballem PJ, Schechter MT. *The B.C. Prenatal Study: 1989-94.* Final Report to LCDC, January 1995.

11. Morrisset R, Czyziw E, Agbaka O, Lambert J. *HIV infection in young Canadian adults before and after an International Exchange Program: 1986-96.* 6th Conference of the International Society of Travel Medicine, Montreal, Canada, June 1999.

12. Houston S. *HIV Risk Behaviours among Canadians: An Inventory and Synthesis.* Division of HIV Epidemiology, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, November 1998.

13. Poulin C. *Nova Scotia Student Drug Use 1996: Technical Report.* Dalhousie University, November 1996.

14. Galambos NL, Tilton-Weaver LC. *Multiple-Risk Behaviour in Adolescents and Young Adults.* Health Reports 1998; 10 (2): 9-20.

15. Tam R, MacDonald N, Feder S, Giglia L, Peeling R, Gully P, Toye B, Doherty J. *Chlamydia Infection in Street Youth: Need for More Aggressive Screening Programs.* Canadian Journal of Infectious Disease 1995; 7:49-52.

16. Wadhera S, Millar WJ. *Teenage Pregnancies, 1974 to 1994.* Health Reports, Winter 1997; 9(3):9-17.

17. Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada. *Genital Chlamydia in Canada.* STD Epi Update, May 1999.

18. Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada. *Gonorrhea in Canada.* STD Epi Update May 1999.

19. Roy E, Haley N, Boivin J-F, Vincelette J, Frappier J-Y, Lemire N. *Hepatitis B and C among Street Youth in Montreal.* Final report submitted to LCDC, Division of HIV/AIDS Epidemiology, and Division of Bloodborne Pathogens, June 1997.

20. Roy E, Haley N, Lemire N, Boivin J-F, Frappier J-Y. *Predictors of Drug Injection Initiation among Street Youth* The Canadian Journal of Infectious Diseases, 1998; 9 Suppl A: 47A. {Abstract 272P}.

21. Adalf M, Ivis FJ, Smart RG, Walsh GW. *Ontario Student Drug Use Survey: 1977-1997.* Toronto: The Addiction Research Foundation, 1997.

22. Houston S, Archibald CP, Strike C, Sutherland D. *Factors Associated with HIV Testing among Canadians: Results of a Population-Based Survey.* International Journal of STD & AIDS 1998; 9: 341-346.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

HIV and AIDS Among Women in Canada

Introduction

The HIV/AIDS epidemic in Canada has changed from the early epidemic that affected men who have sex with men (MSM) to the current epidemic that affects other groups such as injection drug users (IDU), male heterosexuals and women. The HIV epidemic among women is of particular concern because of the potential for transmission to their infants. This report updates the status of HIV and AIDS among women in Canada.

AIDS among Women[1]

In Canada, of the 16,913 AIDS cases reported to the Bureau of HIV/AIDS, STD and TB up to December 31, 1999, 1,345 (8.0%) were among females: 1,252 among adult women (15 years and over), and 93 among female children (less than 15 years of age).

The proportion of AIDS cases among adult women (relative to all reported AIDS cases for which gender and age are known) has increased over time, from 5.6% before 1990, to 7.7% in 1994, and most recently, 16.3% in 1999.

Among all cumulative reported AIDS cases among adult women, 22.0% are attributed to IDU, 63.5% to heterosexual sexual contact, and 10.4% to blood and blood products. Over time, there has been an increase in the proportion of adult female AIDS cases attributed to IDU, from 7.3% before 1990, to 26.6% in 1994 and as high as 43.8% in 1998. Of all reported AIDS cases among women in 1999, 31.7% were attributed to IDU.

HIV infected pregnant women can transmit HIV to their infant. As of December 31, 1999, 82.7% (153/185) of AIDS cases among children 0-14 years of age with known risk category were attributed to perinatal transmission. The *Epi Update* entitled "Perinatal Transmission of HIV" discusses the status of perinatal HIV transmission in Canada.

HIV Testing Programs Provide Valuable Information about Women

While AIDS data provide information on HIV infections that occurred about 10 years in the past, HIV data provide a picture of more recent infections.

Data from provincial and territorial HIV testing programs revealed that at the national level, females represent 13.6% (5,090/37,408) of all positive HIV tests with known age and gender reported to the Bureau of HIV/AIDS, STD & TB between November 1, 1985 and December 31, 1999. Of these positive HIV test reports, 4,856 were among women ($\geq$ 15 years) and 234 among female children (< 15 years)[1].

Before 1995, adult women represented 9.6% of all positive HIV test reports with known age and gender in Canada. In 1995, this proportion increased to 18.5%, and now stands at 23.9% in 1999.

Among women, the primary exposure categories associated with HIV infection are injection drug use (IDU), heterosexual sexual contact and blood

& blood products (Table 1).

Table 1: Proportion of Positive HIV Tests Among Adult Females by Exposure Category and Year of Test, Canada.

	Exposure Category		
Year	**IDU**	**Blood & Blood Products**	**Hetero-sexual Contact**
1985-94	31.8%	12.4%	43.7%
1995	53.9%	3.7%	25.4%
1996	51.0%	1.3%	34.9%
1997	44.8%	1.4%	32.9%
1998	37.3%	3.6%	36.9%
1999	46.1%	1.2%	36.6%

Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000

HIV Data Suggest Increasing Infection among Canadian Women

Using data from HIV serodiagnostic databases, epidemiologic studies, and behavioural surveys, the Bureau of HIV/AIDS, STD & TB estimates that by the end of 1996, approximately 40,000 Canadians were living with HIV, including an estimated 4,600 women. The estimated proportion of women among new HIV infections has increased steadily over time[2] (Figure 1).

Figure 1: Estimated Proportion of Women among New HIV Infections

Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000

Women Can Access Perinatal HIV Screening in Canada

In all Canadian provinces, HIV testing of pregnant women remains the choice of the woman. However, many provinces have guidelines and/or recommendations for physicians to encourage informed decisions in terms of HIV testing during pregnancy. The *Epi Update* entitled "Perinatal Transmission of HIV" discusses the various provincial programmes and presents data from some of these programmes.

HIV among Pregnant Women and Women of Childbearing Age: Not Only in Large Metropolitan Centres

HIV prevalence studies among pregnant women indicated a rate for Canada of about 3-4/10,000. Provincial rates have ranged from 1.9/10,000 (Ontario 1991-92[3]) to 8.7/10,000 (Newfoundland 1991-93[4]) and large metropolitan areas have higher rates (4.7 for Vancouver versus 3.4 for the rest of B.C. in 1994[5] and 15.3 for Montreal versus 5.2 for the province of Quebec in 1990[6]). However, even provinces without large metropolitan areas can have significant rates (for example, 4.1/10,000 in New Brunswick for 1994-96[7]) and data from Manitoba suggest an increasing trend of HIV infection among women of childbearing age (from 0.7/10,000 in 1991 to 3.2/10, 000 in 1994-1995[8]). Studies are currently underway in Ontario and BC (Aboriginal women only) to update the prevalence of HIV among women of child-bearing age.

HIV/AIDS Mortality Rising among Canadian Women[9]

In Canada, age-specific death rates for women aged 25-44 with HIV/AIDS have risen from 0.4/100,000 in 1987 to 1.9/100 000 in 1994. HIV/AIDS mortality among women aged 25-44 appears to be approaching the levels associated with other leading causes of death in this age group, such as heart disease (2.37/100,000 in 1994) and lung cancer (3.18/100,000 in 1994).

Comment

Canadian women are increasingly becoming infected with HIV, especially those who use injection drugs and whose sexual partners are at increased risk for HIV. Pregnant women are at risk for transmitting HIV to their unborn children.

Detecting HIV infection before or during early pregnancy can reduce the likelihood of vertical transmission of HIV (from mother to infant) significantly if the woman and her child are offered timely antiretroviral treatment.

All women, especially women of childbearing age, should have access to HIV testing, counselling and care. Better data on the trends, risk factors and geographic shifts of HIV among Canadian women are needed to help target prevention and care programs.

References

1. Health Canada. *HIV and AIDS in Canada. Surveillance Report to December 31, 1999.* Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, April 2000.

2. Archibald CP, Remis RS, Farley J, Sutherland D. *Estimating HIV Prevalence and Incidence at the National Level: Combing Direct and Indirect Methods with Monte-Carlo Simulation.* XI International Conference on AIDS, Geneva, Switzerland, June-July 1998 (Abstract 43475).

3. Coates RA, Frank JW, Jackson L et al. *The Ontario Seroprevalence Study of Childbearing Women.* Can J Infect Dis 1992; 3 (suppl A): 16A-17A.

4. Ratnam S, Hankins C. *The Newfoundland Prenatal Study of HIV Seroprevalence.* Canadian Association for HIV Research Annual Meeting, Toronto 1994 (Abstract 20).

5. Pi D, Ballem PJ, Schechter MT. *Final Report: The BC Prenatal Study: 1989-94 Final Report to LCDC*, January 1995, and Rekart M. *HIV in Pregnancy.* BC AIDS Update Quarterly Report: 4th Quarter 1995.

6. *Seroprevalence of HIV-1 Antibodies in Women Giving Birth to Live Infants - A Five Year Trend Analysis for Selected Regions Outside Montreal, 1989-93.* Report to LCDC, November 1994. Hankins D, Laberge C, Lapointe N et al. *HIV Infection among Quebec women giving birth to live infants.* J Can Med Assoc 1991; 144 (3): 277-80, and personal communication with Dr. C. Hankins, November 1992.

7. Getty G, Leighton P, Mureika R et al. *Seroprevalence of HIV Infection in Pregnant Women in New Brunswick.* Can J Infect Dis Mar/Apr 1997; vol 8 (suppl A): 24A.

8. Blanchard J, Hammond G, Fast M et al. *Manitoba Antenatal Study.* Final Report to LCDC, June 1996.

9. Hogg RS, Strathdee SA, Heath K et al. *Regional and Gender Differentials in Patterns of HIV/AIDS Mortality in Canada.* Can J Infect Dis 1997; 8:29A.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

Perinatal Transmission of HIV

Introduction

Perinatal (or vertical) transmission of HIV is the transmission of HIV from an HIV-infected pregnant women to her newborn child. Transmission can occur during gestation (in utero), during delivery (when the fetus makes contact with maternal blood and mucosa in the birth canal) or after delivery, through breastmilk. Therefore, women of childbearing age (15-44 years) are of particular importance since they may transmit HIV infection to their newborn children.

In this report the status of perinatal HIV transmission in Canada and the status of HIV testing recommendations for pregnant women are discussed.

AIDS Case Reports

A total of 16 913 AIDS cases had been reported to LCDC to December 31, 1999, including 1 252 cases (7.4%) among adult women (aged 15 and older). Of these, 993 (79%) were among women of childbearing age (15-44 years).

In Canada to December 31, 1999, 196 pediatric AIDS cases (children 0-14 years) were reported, and 153 (78%) were attributed to perinatal transmission.

HIV among Pregnant Women and Women of Childbearing Age

HIV prevalence studies among pregnant women indicate a provincial rate for Canada of about 3-4/10,000, although data for some provinces have not been updated for five or more years. The provincial range is from 1.9/10,000 (Ontario 1991-92[1]) to 8.7/10,000 (Newfoundland 1991-93[2]) and large metropolitan areas have higher rates (4.7 for Vancouver versus 3.4 for the rest of B.C. in 1994[3] and 15.3 for Montreal versus 5.2 for the province of Quebec in 1990[4]). However, even provinces without large metropolitan areas have significant rates (for example, 4.1/10,000 in New Brunswick for 1994-96[5]) and data from Manitoba suggest an increasing trend of HIV infection among women of child-bearing age (from 0.7/10,000 in 1991 to 3.2/10, 000 in 1994-1995[6]).

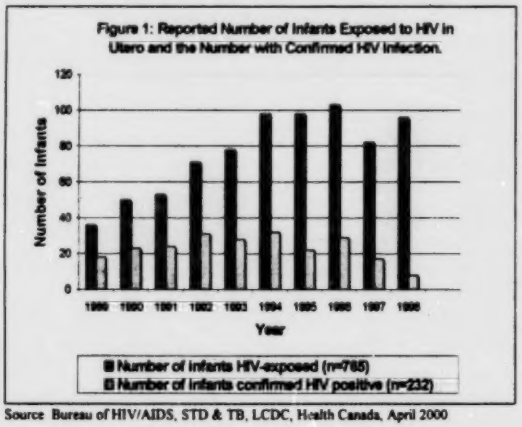
Transmission of HIV from Mother to Child

In Ontario, between 1984 and 1989, there were 34 HIV-infected infants born to HIV-positive mothers; during the period 1990 to January 1997, the number of infants infected vertically from their mothers jumped to 59. Overall, during the period 1984 to January 1997, just over 58% of the HIV-positive mothers reported their risk factor for HIV as being from an endemic country, where heterosexual transmission of HIV is the most likely mode of transmission[7].

The Canadian Pediatric AIDS Research Group (CPARG) follows HIV-infected pregnant women to monitor the outcomes of their infants. Nationally, over the past decade, the number of infants born to HIV-infected mothers (HIV-exposed infants) increased steadily until 1994 and has been approximately constant since then[8].

Figure 1 below depicts the reported number of infants born to HIV positive mothers and the number of infants with confirmed HIV infection.

Of the reported total of 765 infants who were exposed to HIV from their mothers between 1989 and 1998, 232 have been confirmed HIV positive and an additional 61 have indeterminate serostatus and are being monitored. Of the exposed infants, over the past decade, an increasing proportion had received some treatment during the course of their gestation and after birth.



Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

Provincial Prenatal HIV Screening Recommendations

In all Canadian provinces, HIV testing of pregnant women remains the choice of the woman. However, many provinces have guidelines and/or recommendations for physicians to encourage informed decisions in terms of HIV testing during pregnancy.

Newfoundland: In 1997, the Newfoundland and Labrador Advisory Committee on Infectious Diseases recommended that HIV testing be added to the existing prenatal screening program. HIV testing is done as part of the routine prenatal screen, unless the woman declines. The Newfoundland and Labrador Medical Association and the provincial Public Health Laboratory and Department of Health and Community Services have supported this recommendation and have worked to actively notify physicians and patients of this recommendation[9].

Prince Edward Island: In June 1999, the PEI Department of Health and Social Services formally adopted a policy of supporting HIV testing for all pregnant women and recommends that physicians offer HIV testing at the first prenatal visit[10].

Nova Scotia: The Reproductive Care Program recommends that HIV testing should be offered to all pregnant women, together with other prenatal tests in the first trimester. Women who decline testing in the first trimester or who are known to engage in high risk activities should be offered testing again during the latter stages of their pregnancy[11].

New Brunswick: The New Brunswick Medical Society's Subcommittee on Perinatal Health Care recommended, in July 1999, that physicians should routinely encourage all pregnant women to be tested for HIV with appropriate pre- and post-test counselling and informed consent. In addition, nominal and non-nominal HIV testing and counselling are available through physicians and sexual health centres, and anonymous testing is available at sexual health centres[12].

Quebec: Since 1997, as part of an intervention program on HIV infection and pregnancy, the Ministry of Health and Social Services, in accordance with the College of Physicians, initiated a program recommending that all pregnant women and women contemplating pregnancy be offered an HIV test[13].

Ontario: On December 1, 1998, the Minister of Health announced that the prenatal screening program would be expanded to include HIV testing. Through this expanded program, all pregnant women are offered an HIV test as part of their prenatal care. The HIV test is performed only after counselling is provided and informed consent is given. Health providers must complete the laboratory requisition to confirm that these two provisions have been met. Laboratory requisitions not meeting these criteria are not processed[14].

Manitoba: The College of Physicians has issued their "Guidelines to Practice" which include approval of a policy, adopted in 1994, that all physicians offer pre-test counselling and HIV testing, with informed consent, to all pregnant women [15].

Saskatchewan: The College of Physicians issued guidelines for physicians to assess a woman's risk and inform her that testing is available[16].

Alberta: On September 1, 1998, HIV screening was added to the routine prenatal blood tests for all women in Alberta. HIV screening is done unless the woman declines to be tested. Canadian Blood Services laboratories in Calgary and Edmonton do the initial HIV screening on prenatal blood samples received for blood grouping, Rh determination, anti-erythrocyte antibodies and hepatitis B serology. Repeatedly reactive samples are sent for confirmation testing by the Provincial Public Health Laboratories[17].

British Columbia: In June 1994, the B.C. Ministry of Health recommended that HIV testing be offered as a routine prenatal component, with informed consent and pre- and post-test counselling[18].

Northwest Territories: In 1993, the Northwest Territories Maternal and Perinatal Committee, which has representation from the Department of Health and Social Services and the Northwest Territories Medical Association, recommended that all pregnant women be tested for HIV. In 1998, screening for HIV became fully integrated with routine prenatal care, although women are provided the opportunity to opt out[19].

Yukon: In 1994, the Chief Medical Officer of Health, in conjunction with Yukon Communicable Disease Control, "strongly recommended" testing of all pregnant women. Women who present for testing are also encouraged to recommend their partner be tested as well[20].

Canadian Women Can Access Prenatal HIV Screening Programmes

Data from prenatal HIV screening programmes can provide important information on the effectiveness of prenatal HIV screening recommendations. Below are data from several provinces:

Alberta: During the first year of their programme, of the approximately 52,000 eligible pregnancies, 4% declined testing. These data have found 15 HIV+ women, for a rate of 2.91/10 000. In the next six months (Sept. 1999 - Feb. 2000), 2.6% of pregnant women declined testing and the HIV prevalence rate was 2.12/10 000.

Quebec: Before the initiation of their prenatal HIV screening program in July 1997, it was estimated that about 45% of women were tested during pregnancy. From May 1997 to January 1998, a 22% increase in the number of pregnant women were tested, which represents about 75% of the births recorded during that time period. Between July 1997 and May 1998, 15 pregnant women were identified as HIV+ [21].

Manitoba: By comparing laboratory requisitions for HIV serology and requisitions for routine prenatal tests, the provincial public health laboratory estimates that the proportion of pregnant women tested for HIV during pregnancy has increased dramatically in recent years, from about 10% of pregnant women screened for HIV in 1996, to 37% in 1997 and to about 60% in 1999. The rate of HIV+ women identified through prenatal screening increased from 2.1/10 000 in 1997/1998 (3 HIV+/14,193 pregnancies) to 5.51/10 000 (8/14,526) in 1998/1999[22].

Antiretroviral Treatment Can Reduce the Likelihood of Transmission of HIV from Mother to Infant During Pregnancy

HIV testing during pregnancy can provide the opportunity to offer antiretroviral treatment to the mother and infant. For example, a full AZT protocol, which includes administering AZT to the mother during the second or third trimester, during labour and delivery, and after delivery to the infant for 6 weeks can reduce the likelihood of transmission of HIV from mother to newborn by about 2/3[23]. Clinical trials in developing countries have recently shown that short course AZT regimes

(given to pregnant women starting at 36 weeks gestation and during labour) can reduce vertical transmission rates by about 50%[24]. Recent studies indicate that even greater reductions can be achieved using single-dose nevirapine [25].

In B.C., between 1993 and 1996, the use of antiretroviral therapy (AZT) reduced the likelihood of HIV transmission from mother to infant from 22% transmission among mother-infant pairs who had not received any AZT, to 14% for mother-infant pairs who had received some AZT therapy and 5% among those who received the full AZT protocol [26]. Similarly, a study at Sainte Justine's Hospital in Montreal found a reduction in the HIV vertical transmission rate from 28.3% in untreated women-infant pairs 3.75% in AZT-treated pairs[27].

Canadian Prenatal HIV Screening Programmes Are Valuable

Screening pregnant women for HIV clearly represents an important opportunity to prevent the transmission of HIV to infants. From the perspective of a cost-benefit analysis (which includes the costs of screening tests, counselling and treatment), the benefit of screening is obviously greater in areas with higher HIV prevalence among child-bearing women. For areas of lower HIV prevalence, the benefit per unit cost is more dependent on variables such as whether physicians bill separately for the counselling time associated with prenatal HIV testing[28]. It is estimated that if such programs screened 90% of pregnant women across Canada, there would be a 65% reduction in the number of HIV-infected newborns (compared to no prenatal testing and assuming 24% of untreated pregnancies and 6% of treated pregnancies result in HIV-infected infants)[29]. Assuming HIV prevalence rates of 6/10,000 among pregnant women in BC, Ontario and Quebec and 3/10,000 elsewhere, this reduction in absolute number terms would be from 56 to 20 infected newborns, or 36 infections prevented annually.

Comment

There is still a risk for the perinatal transmission of HIV in Canada and as more women are becoming infected, this risk is increasing. Elsewhere we have estimated that approximately 15,000 Canadians (including women) are HIV-infected but unaware of their infection (see *Epi Update* entitled "HIV Prevalence and Incidence in Canada"). Given this, and the fact that perinatal infections are preventable, it is important that all pregnant women, and women considering pregnancy, should have access to prenatal care that includes the offer of HIV testing as well as appropriate counselling and care.

References

1. Coates RA, Frank JW, Jackson L et al. *The Ontario HIV Seroprevalence Study of Childbearing Women.* Can J Infect Dis 1992; 3(suppl A): 16A-17A.

2. Ratnam S, Hankins C. *The Newfoundland Prenatal Study of HIV Seroprevalence.* Canadian Association of HIV Research Annual Meeting Toronto, 1994 (abstract 20).

3. Pi D, Ballem PJ, Schechter MT. *Final Report: The BC Prenatal Study: 1989-94.* Final Report to LCDC, Jan 1995, *and* Rekart M. *HIV in pregnancy.* BC AIDS Update Quarterly Report: 4th Quarter 1995.

4. *Seroprevalence of HIV-1 antibodies in women giving birth to live infants: a five-year trend analysis for selected regions outside Montreal, 1989-93.* Report to LCDC, Nov 1994, and Hankins D, Laberge C, Lapointe N et al. HIV infection among Quebec women giving birth to live infants. Can Med Assoc 1991; 144 (3): 277-80.

5. Getty G, Leighton P, Mureika R et al. *Seroprevalence of HIV infection in pregnant women in New Brunswick.* Can J Infect Dis Mar/Apr 1997 vol 8(suppl A):24A.

6. Blanchard J, Hammond G, Fast M et al. *Manitoba Antenatal Study.* Final Report to LCDC, June 1996.

7. *Using HIV Perinatal Surveillance Data for the Evaluation of Prevention Intervention: Provincial example, Ontario* Dr. R. Remis In: Proceedings of a Scientific Meeting to review the Vertical Transmission of HIV in Canada. Ottawa, Ont June 11, 1998.

8. Health Canada. *HIV and AIDS in Canada: Surveillance Report to December 31, 1998.* Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD, and TB, LCDC, Health Canada, April 1999.

9. Communication with Ms. C. O'Keefe, Disease Control and Epidemiology, Department of Health and Community Services, Nfld. Apr 1998.

10. Communication with J. MacDonald, PEI Department of Health & Social Services, March 2000.

11. Communication with M. FarhangMehr, Coordinator, Communicable Disease Prevention and Control, Halifax, March 2000.

12. Communication with T. Christie, Department of Health and Community Services, NB, March 2000.

13. Communication with Dr. D. Auger, Centre québécois de coordination sur le sida, March 2000.

14. Communication with Ms. J. Tripp, Project Officer, AIDS Bureau, Ontario Ministry of Health, Apr 1999.

15. Communication with P. Matusko, Program Coordinator, AIDS/STD Programs, Manitoba Health, Apr 1999.

16. Communication with Dr. E. Young, Deputy Chief MOH, Saskatchewan Health, Apr 1999.

17. Communication with Dr. B. Larke, Medical Director, Provincial AIDS Program, Alberta Health, Apr 1999.

18. Communication with Dr. M. Rekart's office, BC Centre for Disease Control, Oct 1997.

19. Communication with Dr. Andre Corriveau, Director, Population Health and Chief Medical Health Officer, NWT, Apr 1999.

20. Communication with P. Mandl, Communicable Disease Officer, Yukon Territory, Apr 2000.

21. *HIV Testing Strategy in Quebec: Report and results of first year initiatives* Dr. D. Auger, Centre Quebecois de coordination sur la SIDA (CQCS), Montreal Que In: Proceedings of a Scientific Meeting to Review the Vertical Transmission of HIV in Canada Ottawa June 1998.

22. Communication with Dr. M. Dawood, Director of the Public Health Laboratory, Cadham Provincial Lab, Winnipeg, Manitoba, Apr 1999.

23. Connor EM, Sperling RS, Gelber R et al. *Reduction of maternal-infant transmission of human immunodeficiency virus type 1 with zidovudine treatment.* Pediatric AIDS Clinical Trials Group Protocol 076 Study Group. N Engl J Med 1994;331:1173-80.

24. Shaffer N, Chuachoowong R, Mock P, et al. *Short Course Zidovudine for Perinatal HIV-1 Transmission in Bangkok, Thailand: A Randomized Clinical Trial.* Lancet Vol 353 No 9155 p 773.

25. Marseille E, Kahn JG, Mmiro F, Guay L, Musoke P, Fowler MG, Jackson JB. *Cost effectiveness of single-dose nevirapine regimen for mothers and babies to decrease vertical HIV-1 transmission in sub-Saharan Africa.* Lancet 1999 354(9181): 803-9.

26. Forbes J, Burdge DR, Money D. *Pregnancy outcome in HIV-infected women in British Columbia: the impact of antiretroviral therapy on maternal-infant HIV transmission.* Can J Infect Dis Mar/Apr 1997 vol 8(supplA):31a.

27. *Antiretroviral Therapy in Pregnant Women (CPARG): Access and Outcome (1995-1997) and the Experience of Transmission of HIV in Treated Pregnant Women at Ste. Justine's Clinic, Quebec* Dr. Normand Lapointe In: Proceedings of a Scientific Meeting to Review the Vertical transmission of HIV in Canada June 1998.

28. Nagarajan KV, Sahai V, Pong RW. *Screening pregnant women for HIV infection in Ontario: Economic and human resource implications.* Final report submitted to Bureau of HIV/AIDS, STD & TB, LCDC. Mar 1998.

29. Archibald CP, Farley J, Yan P, Sutherland J, Sutherland D. *Estimating the impact of antenatal HIV testing in Canada: a lesson on the difference between efficacy and effectiveness.* Canadian Conference on HIV/AIDS Research, Quebec City, May 1999; Can J Inf Dis 1999; 10 (Suppl B): 43B, Abstract C304.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

AIDS and Ethnicity in Canada

Introduction

Due to the unique perspective it offers on the HIV/AIDS epidemic, the reporting of ethnicity information has become an integral component of the national HIV and AIDS surveillance system. As with other demographic information, ethnicity information from individuals diagnosed with HIV infection or AIDS can contribute to the development and evaluation of targeted prevention programs, and also to the development of policy.

This Epi Update presents a summary of ethnicity information from the national HIV and AIDS surveillance systems.

Improved Ethnicity Reporting Among AIDS Cases[1]

Since 1982, when the first AIDS case was diagnosed in Canada, 85.5% (14,463/16,913) of AIDS diagnoses have reported ethnicity information. The consistency of ethnicity reporting in AIDS cases has improved over time. In 1990, 84.5% of AIDS case diagnoses have ethnicity information. This figure has since increased to 87.8% and 93.7% in 1995 and 1999, respectively.

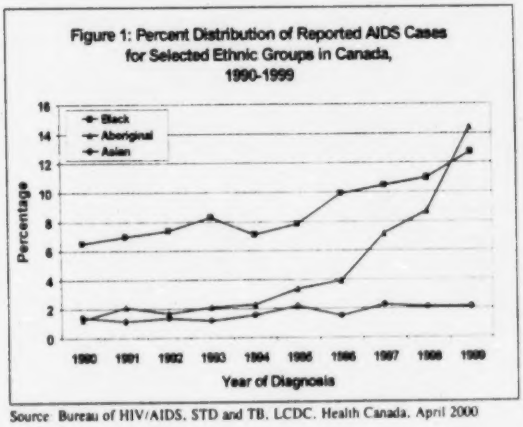
For AIDS diagnoses in 1999, 65.6% were reported among Whites, marking a continuous decline in the proportion of AIDS cases among this ethnic group since 1990 (Table 1).

Other ethnic groups have witnessed a corresponding increase in their proportion of reported AIDS cases, and this increase is particularly dramatic among Aboriginal persons (Figure 1).

Table 1: Proportion of Reported AIDS Cases Among Whites in Canada for Selected Years.

Year	1990	1993	1996	1999
Percent	88.8%	86.3%	82.1%	64.4%

Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000



Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000

Reported AIDS Cases Not Decreasing Among Aboriginal People

Although Aboriginal persons represent 2.6% (371/14,463) of all AIDS cases with reported ethnicity, this percentage is not indicative of the underlying trend, as Aboriginal persons represent an increasing percentage of AIDS case reports with known ethnicity (Figure 2).

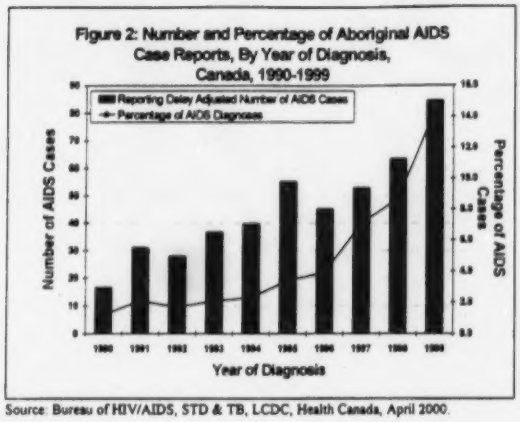


Figure 2: Number and Percentage of Aboriginal AIDS Case Reports, By Year of Diagnosis, Canada, 1990-1999
Reporting Delay Adjusted Number of AIDS Cases
Percentage of AIDS Diagnoses
Number of AIDS Cases
Percentage of AIDS Cases
Year of Diagnosis

Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000.

Furthermore, while information from AIDS case reports indicates that overall there has been a decline in the number of AIDS case reports, recent data indicate that the number of AIDS cases among Aboriginal persons is not participating in this general decline. Instead, the number of AIDS cases reported among Aboriginal persons has remained stable since the mid 1990's (Figure 2).

Positive HIV Tests Often Reported Without Ethnicity Information

Because of it's newness and confidentiality issues, positive HIV test reporting does not enjoy the same comprehensive level of reporting in many provinces as does AIDS. Consequently, it is more difficult to access national ethnicity data on newly-determined positive HIV test reports. Thus, ethnicity data for positive HIV test reports is available only for some provinces and/or territories.

In 1998, 25.6% (597 cases) of the 2,330 positive HIV tests had associated ethnicity information. In 1999, this number increased to 29.1% (650 cases) of 2,231 positive HIV tests reported.

The majority of positive HIV test reports with reported ethnicity information are among Whites, representing 67.0% and 60.0% of HIV cases in 1998 and 1999, respectively.

Aboriginal People Constitute Significant Proportion of Positive HIV Tests With Known Ethnicity

Although the percentage of positive HIV tests with reported ethnicity is low (27.3% since 1998), Aboriginal persons constitute a significant proportion of positive test reports. Although Whites still comprise the majority of cases with reported ethnicity, Aboriginal persons represent a growing proportion of positive tests. In 1998, 19.4% of positive tests were among Aboriginal people as compared to 24.8% in 1999.

Since ethnicity data for positive HIV tests is only available since 1998, comparisons can only be made for this limited period of time.

Table 2: Comparison of Positive HIV Test Reports Among Aboriginal persons to Non-Aboriginals in Canada, 1998-1999.

	Aboriginal	Non-Aboriginal
Gender	**n = 274**	**n = 966**
Male	50.4%	80.0%
Female	49.6%	20.0%
Age (Yrs)	**n = 277**	**n = 970**
20-29	33.6%	19.2%
30-39	40.1%	42.9%
Exp. Cat.	**n = 268**	**n = 926**
MSM	10.4%	31.6%
IDU	59.3%	33.7%
HET	20.1%	26.2%

Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000.
MSM = Men who have sex with men
IDU = Injection Drug Use HET = Heterosexual Contact

Table 2 illustrates that gender and exposure category distributions for Aboriginal HIV test reports is significantly different than that for non-Aboriginals. However, it should be noted that these observations are only preliminary, as the majority of positive HIV test reports with associated

ethnicity information come from areas where the Aboriginal population is higher than in other parts of Canada (British Columbia, Yukon Territory, Alberta, Saskatchewan, Manitoba, Nova Scotia, PEI and Newfoundland). For the remaining provinces and territories, ethnicity data on positive HIV test reports is not available.

Limitations of Ethnicity Data from Reported HIV and AIDS Cases

There are several significant limitations regarding the accuracy of ethnicity data obtained from HIV and AIDS surveillance information.

- Misclassifications in ethnic status may occur at the time of HIV or AIDS diagnosis.
- Patients in certain communities may not wish to identify their ethnicity, resulting in under-representation of certain ethnic groups.
- For AIDS reporting, patients and physicians are constrained by the list of ethnic categories available on the AIDS Case Report Form. Choosing from a pre-defined and limited list may compromise the accurate reporting of ethnicity.
- Not all provinces and territories put the same priority on routinely collecting and/or reporting ethnicity status.
- Variations in the completeness of ethnicity reporting between and within provinces may result in a systematic over- or under-representation of specific communities.
- Reporting delay may vary by ethnicity, and therefore, will affect the representativeness of ethnicity data for reported HIV and AIDS cases.

Given these limitations, caution should be exercised in interpreting the HIV and AIDS ethnicity data presented. This is particularly true of the HIV test report data for which there is a paucity of ethnicity information.

Comment

Despite the limitations associated with ethnicity reporting, available evidence suggests that Aboriginal people are infected at a younger age than non-Aboriginal people, that injection drug use is an important mode of transmission, and that the HIV epidemic among Aboriginal people shows no sign of abating. For additional information on HIV/AIDS and Aboriginal people, refer to *Epi Update* entitled "HIV and AIDS Among Aboriginal People in Canada".[2]

Ethnicity information is useful to community health groups and public health officials for planning outreach and public health campaigns whose goals are to reduce the spread of HIV and to treat affected members of their respective communities.

As with other descriptors of the HIV/AIDS epidemic, such as gender, age group, and exposure category, ethnicity information on positive HIV tests and reported AIDS cases may assist community health care providers to focus preventive health care more effectively.

For a more complete understanding of how the HIV/AIDS epidemic in Canada is affecting different ethnic populations, the completeness and accuracy of ethnicity reporting needs to be improved.

References

1. Health Canada. *HIV and AIDS in Canada: Surveillance Report to December 31, 1999.* Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, April 2000.
2. Health Canada. "HIV and AIDS Among Aboriginal People in Canada," *HIV/AIDS Epi Updates*, Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, April 2000.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

HIV and AIDS Among Aboriginal People in Canada

Introduction

In recent years, the HIV/AIDS epidemic among Aboriginal people in Canada has become a serious concern, particularly among those living in inner-cities. This report updates current information on the status of the HIV/AIDS epidemic among Canada's Aboriginal people.

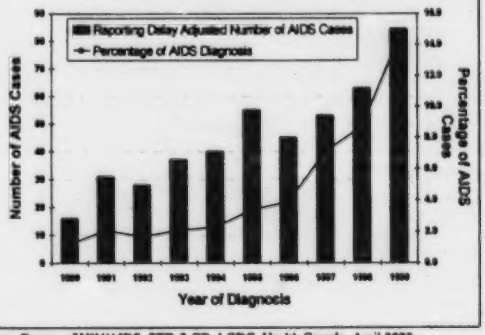
Pattern of AIDS is Different among Aboriginal People

Increasing trend over time:

- As of December 31, 1999, a cumulative total of 16,913 AIDS cases were reported to the Bureau of HIV/AIDS, STD and TB, and of these, 371 were indicated as Aboriginal[1].

- Although Aboriginal persons represented 2.4% of AIDS cases with known ethnicity (n=15,273), the annual proportion of AIDS cases attributed to Aboriginal persons has increased over time, from 1% before 1990 to 15% in 1999 (Figure 1). This graph also shows that the annual number of Aboriginal AIDS cases steadily increased until 1995 and has remained stable since then (numbers adjusted for reporting delay). This trend is in contrast with a recent decline in the overall number of reported AIDS cases (see *Epi Update* "HIV and AIDS in Canada")[2].

Figure 1: Annual Number and Percentage of Aboriginal AIDS Case Reports, Canada, 1990-1999


Reporting Delay Adjusted Number of AIDS Cases
Percentage of AIDS Diagnosis
Number of AIDS Cases
Percentage of AIDS Cases
Year of Diagnosis

Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

Injection drug use (IDU), a major risk factor:

- Exposure categories for the 288 cumulative male Aboriginal AIDS case reports were: men who have sex with men (MSM) 52.4%, IDU 24.0%, MSM/IDU 13.2%, heterosexual contact 5.5%, receiving blood/clotting factors 0.7%, perinatal transmission 1.4%, non-identified risk factor (NIR) 1.4%, and NIR-Heterosexual 1.4%[1].

- Exposure categories for the 82 cumulative female Aboriginal AIDS case reports were: IDU 58.5%, heterosexual contact 24.4%, receiving blood/clotting factors 2.4%, perinatal transmission 2.4%, NIR 4.9%, and NIR-Heterosexual 7.3%[1].

- The proportion of Aboriginal AIDS cases attributed to IDU category has dramatically increased over time, from 5% (before 1991) to 19% (1991-93), 34% (1994-96), and 51% (1997-99)[1].

Aboriginal AIDS cases are younger, more likely to be women, and more likely to be infected by injection drug use:

- Aboriginal AIDS cases are younger than non-Aboriginal AIDS cases (28.6% vs 17.1% were diagnosed at less than 30 years of age)[1].

- The proportion of women among Aboriginal AIDS cases is higher than among non-Aboriginal AIDS cases (22.2% vs 7.7%)[1].

- The proportion of AIDS cases attributed to IDU as an exposure category is higher among Aboriginal persons than among non-Aboriginal persons (24.0% vs 4.2% for men, 58.5% vs 18.1% for women)[1].

HIV Data

- While AIDS data provide information on HIV infections that occurred about 10 years in the past, HIV data provide a picture of more recent infections.

- Recent data on diagnosed HIV infections from provinces that report ethnicity (B.C., Alberta, Saskatchewan, Manitoba, Yukon, Newfoundland, Nova Scotia, Prince Edward Islands) found the proportion attributed to Aboriginal persons was 19.4% in 1998 and 24.8% in 1999. Further comparisons showed that Aboriginal persons diagnosed with HIV are younger, more likely to be female, and more likely to be IDU (see Table 1 and *Epi Update* "HIV/AIDS and Ethnicity in Canada")[2].

- In a 1997 study done in Vancouver among 151 HIV-infected Aboriginal participants, IDU (58%) and MSM (14%) were also reported as significant risk factors[3].

Table 1: Comparison of Positive HIV Test Reports Among Aboriginal persons to Non-Aboriginals in Canada, 1998-1999.

	Aboriginal	Non-Aboriginal
Gender	**n = 274**	**n = 966**
Male	50.4%	80.0%
Female	49.6%	20.0%
Age (Yrs)	**n = 277**	**n = 970**
20-29	33.6%	19.2%
30-39	40.1%	42.9%
Exp. Cat.	**n = 268**	**n = 926**
MSM	10.4%	31.6%
IDU	59.3%	33.7%
HET	20.1%	26.2%

Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000
MSM = Men who have sex with men
IDU = Injection Drug Use HET = Heterosexual Contact

- About 28% of people testing anonymously in Saskatchewan and 57% in Prince Albert in 1996 were Aboriginal[4]; 25% of surveyed Aboriginal youth aged 11-19 years in 1998 had been ever tested for HIV (38% in urban areas and 15% in rural areas)[5].

- Of the studies done among Aboriginal people or in sub-populations with Aboriginal markers, HIV prevalence rates in a variety of settings were 0.4%-29.7% in Vancouver (men who have sex with men, Native alcohol and drug treatment centres, inmates, and needle exchange programs-NEPs)[6-10], 1.8%-2.1% in Alberta (Calgary NEP, STD clinics)[11,12], 0.4% in Prince Albert (IDUs, sexual partners of IDUs, and inmates)[13], 13.4% in Winnipeg IDUs[14], 7.7%-7.9% in Ontario (province-wide NEPs, self-report by on-reserve people who had been tested for HIV)[15,16], and 1.4% in Montreal street youth[17]. Overall, these prevalence rates are similar to those of corresponding non-Aboriginal groups, but the relatively small amount of data cannot rule out

the possibility that rates are in fact higher among Aboriginal people.

Infected pregnant Aboriginal women and risk of vertical transmission (from mother to infant)

- Pregnant women are at risk for transmitting HIV to their unborn child. At a BC clinic that cares for the majority of HIV-infected women in the province, between 1989-97, 36% (45/126) of infants born to HIV-positive mother were Aboriginal[18].

- In Northern Alberta, 42% of all infected women seen at HIV clinics during 1992-98 were Aboriginal. This proportion was up to 91% (29/32) among infected women who delivered in Northern Alberta and North West Territories during 1996-98[19].

- A study of all HIV pediatric centres across Canada found that 19% (50/259) of women known to be HIV-positive at the time of their child's birth during 1995-97 were Aboriginal. Pregnant Aboriginal women (62%) were as likely to be on antiretroviral therapy as pregnant Caucasian women (66%) and pregnant Black women (63%)[20].

Aboriginal Injection Drug Users

- Available data suggest Aboriginal persons are over-represented in IDU populations[9-11,13-15,21-24]. Furthermore, cocaine, talwin and ritalin appear to be their drugs of choice; 33%-51% of them had a history of ever sharing needles [10-11,13-15].

- Data from a cohort study (1996-present) among IDUs in Vancouver found there were more Aboriginal people in the HIV-positive group than in HIV-negative group at baseline (30% vs 21%). Furthermore, ever borrowing needles and current methadone treatment were associated with HIV infection among Aboriginal participants[10].

Aboriginal men who have sex with men

- A study done among MSM in Winnipeg in 1995 found 17% of participants were Aboriginal[25].

- In an ongoing study (1996-present) among young MSM in Vancouver where 8% of participants were Aboriginal, Aboriginal MSM were more likely than non-Aboriginal MSM, to be unemployed, to live in unstable housing, to have income of <$10,000, to have higher depression scores, to report non-consensual sex or sexual abuse during childhood, and to be involved in the sex trade[6].

Aboriginal Inmates

- 14% of federal inmates across Canada are Aboriginal, with rates up to 40% in provincial or federal jails in some provinces[8,26-28].

Comment

Aboriginal HIV/AIDS data are under-estimated for several reasons: incomplete ethnic information in HIV and AIDS case reports (75% of HIV cases and 15% of AIDS cases), inter-provincial variations in reporting ethnicity, misclassification in ethnic status, and delays in reporting.

With respect to Aboriginal HIV data, most studies have been done among high risk populations and therefore, the generalizability of these results to the general Aboriginal population is limited. In addition, HIV testing and clinical data are available only for those who came forward for testing and/or treatment; thus they do not represent the total number of Aboriginal people infected with HIV.

Despite these limitations, available evidence suggests that Aboriginal people are infected at a younger age than non-Aboriginal people, that injection drug use is the most important mode of transmission, and that the HIV epidemic among Aboriginal people shows no sign of abating.

Furthermore, the mobility of Aboriginal people between inner cities and rural areas may bring the risk of HIV to even the most remote Aboriginal community.

Better data on HIV/AIDS epidemiology and HIV testing among Aboriginal people in Canada are needed to guide prevention and control strategies.

References

1. Health Canada. *HIV and AIDS in Canada. Surveillance Report to December 31, 1999*, and unpublished data from the Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000.

2. Health Canada. *HIV and AIDS in Canada.* Epi Update, Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000.

3. Assembly of First Nations-The University of British Columbia. *The First Nations Community Health Resources Project.* Final report to the Assembly of First Nations, January 1999.

4. Hudson S. *Saskatchewan HIV Database and Anonymous HIV Testing Program.* Proceedings of the 3rd Annual Aboriginal HIV/AIDS Surveillance and Research Meeting (May 29-30, 1998, Montreal), Division of HIV Epidemiology, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada. Personal communication (Hudson S.) April 1999.

5. Assembly of First Nations-CIET Canada. *First Nations HIV/AIDS Resilience Project.* Final report to the Assembly of First Nations, June 1998 and unpublished data from the Assembly of First Nations, January 2000.

6. Heath KV, Cornelisse PGA, Strathdee SA, PalepA, Miller ML, Schechter MT, O'Shaughnessy MV, Hogg RS. *HIV-associated risk factors among young Canadian Aboriginal and non-Aboriginal men who have sex with men.* Int J STD and AIDS 1999;10:582-7.

7. Mathias RG, Slaney L, Day S, Fetherstonehaugh D, Miller D, Self B et al. *AIDS, Hepatitis and HTLV Infections at First Nations and Alcohol Treatment Centers British Columbia, 1992-1999.* Final report submitted to Medical Services Branch, Pacific Region, January 2000.

8. Rothon DA, Mathias RG, Schechter MT. *Prevalence of HIV infection in provincial prisons in B.C.* Can Med Assoc J 1994; 151(6):781-87.

9. Mathias RG, Riben PD, Schechter MT, Bardsley JE. *Evaluation of the needle exchange program in the cities of Vancouver and Victoria.* Final report to National Health and Research Development Program, 1994.

10. Heath K, Strathdee S, Palepu A, Schechter MT, O'Shaughnessy M, Rekart M. *Determinants of HIV Infection in a Cohort of Native Canadian Injection Drug Users.* Can J Inf Dis 1998;9:30A {Abstract 208}.

11. Guenter D, Fonseca K, Wheeler V, Nielsen D, Pim C. *Calgary Needle Exchange Clients: HIV Prevalence, Demographic, Behaviours.* Final report to Calgary Regional Health Authority, October 1998.

12. Romanowski B, Campbell P, Preiksaitis J, Fonseca K. *Human immunodeficiency virus seroprevalence and risk behaviours in patients attending sexually transmitted disease clinics in Alberta.* Sexually Transmitted Diseases September 1997:487-94.

13. Siushansian J, Vooght M, Archibald C, Young E, Bangura H, Hudson S et al. *The Prince Albert Seroprevalence Study.* Proceedings of the Joint HIV/AIDS/STD Annual Surveillance Meeting (November 17-20, 1999, Calgary), Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

14. Blanchard J, Elliot L, Dawood M, Mestery K, Matusko P, Moses S and al. *The Winnipeg Injection Drug Epidemiology (W.I.D.E.) Study: A Study of the Epidemiology of Injection Drug Use and HIV Infection in Winnipeg.* Can J Infect Dis 1999;10:46B {Abstract C314}.

15. Millson P, Myers T, Calzavara L, Rea E, Wallace E, Fearon M, Major C. *Prevalence of HIV and Other Bloodborne Viruses and Associated Risk Behaviours in Ontario Injection Drug Users.* Proceedings of the 7th Annual HIV Epidemiology Meeting (November 12-14, 1998, Hull), Division of HIV Epidemiology, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

16. Myers T, Calzavara L, Cockerill R, Marshall V, Bullock S, with First Nations Steering Committee 1993. *Ontario First Nations AIDS and Healthy Lifestyle Survey (1993).* National AIDS Clearinghouse, Canadian Public Health Association, Ottawa, Ontario (Catalogue ISBN 0-7727-8750-6).

17. Roy E, Haley N, Boivin JF, Frappier JY, Claessens C, Lemire N. *HIV Infection Among Street Youth in Montreal.* Proceedings of the 3rd Annual HIV/AIDS Surveillance and Research Meeting (May 29-30, 1998, Montreal), Division of HIV Epidemiology, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

18. Forbes J, Burdge DR, Money D. *Pregnancy outcome in HIV infected women in British Columbia; the impact of antiretroviral therapy on maternal-infant HIV transmission.* Can J Inf Dis 1997;8:31A {Abstract 235} and personal communication (Forbes J).

19. Houston S, Birse E, Shokoples S, Lee B. *Trends in the HIV Epidemic in Aboriginal people in Northern Alberta.* Can J Infect Dis 1999;65B {Abstract C386P}.

20. Lapointe N, Forbes J, Singer J, King SM, Allen UD, Read SE and The Canadian Pediatric AIDS Research Group. *Antiretroviral Therapy in Pregnant Women in Canada: Access and Outcome 1995-97.* Can J Inf Dis 1998;9:70A {Abstract 449P}.

21. Abernathy T, Elnitsky S. *Calgary's needle exchange program: profile of injection drug users.* Canadian Journal Public Health 1993; 84:177-80.

22. Wolfe R, Sykes B. *Needleworks: prevention of HIV in injection drug users, report of evaluation: 1994 follow-up.* Edmonton, Alberta: Edmonton Board of Health.

23. Jacobs P, Calder P, Taylor M, Houston S, Duncan Saunders L, Canadian Policy Research Networks Inc. *Cost Effectiveness of Edmonton's street works needle exchange program.* Final report to Canadian Policy Research Networks Inc., March 1998.

24. Campbell and Heinrich Research Associates. *Evaluation of the Street Links Project.* Final report to National Health and Research Development Program, 1992.

25. Myers T, Calzavara L, Morrison K, Marchand R, Major C, Allman D. *A report on a National Research Needs Assessment for HIV prevention among gay and bisexual men and a socio-behavioural and epidemiological pilot study in a non-clinical sample of self-identified gay and bisexual men.* Final report to the Bureau of HIV/AIDS and STD, August 1995.

26. Portman J (personal communication, October 1996). Correctional Services Canada.

27. Sandra Harrison (personal communication, March 1997). Alberta Justice.

28. Rothon DA, Strathdee SA, Cook D, Cornelisse PGA. *Determinants of high risk behaviours for HIV infection among young offenders in British Columbia detention centres.* Can J Infect Dis 1995;6:56B.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

HIV/AIDS Among Men Who Have Sex With Men

Introduction

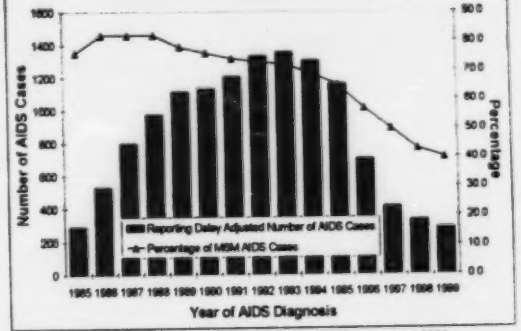
The HIV/AIDS epidemic in Canada no longer affects men who have sex with men (MSM) to the same extent that it did in the early-to-mid 1980s. However, this group is still a significant part of the epidemic. This report updates the current information on the status of HIV and AIDS among MSM in Canada.

AIDS Data

- As of December 31, 1999, a cumulative total of 16,913 AIDS cases had been reported to the Bureau of HIV/AIDS, STD and TB. Among 15,463 adult male AIDS cases, 79.2% of them were attributed to MSM and an additional 5.0% were attributed to the combined category of MSM and injection drug use (IDU)[1].

- Figure 1 shows that the annual number of AIDS cases attributed to MSM,adjusted for reporting delay, leveled off from 1992 to 1994 and has decreased since then, likely due to availability of new, more effective treatments and perhaps also due to decreased reporting completeness (see *Epi Update* entitled "AIDS and HIV in Canada"). The graph also shows a decrease over time in the proportion (adjusted for reporting delay) of MSM AIDS cases since 1987-88. The proportion of cases attributed to the category MSM/IDU was 3.7% of cases before 1990, 6.1% during 1994-96, and 4.8% during 1997-99[1].

Figure 1: Annual Number and Percentage of AIDS Cases Attributed to MSM, Canada, 1985-1999


Number of AIDS Cases
Percentage
Year of AIDS Diagnosis
MSM Reporting Delay Adjusted Number of AIDS Cases
Percentage of MSM AIDS Cases

Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

- While AIDS data provide information on HIV infection that occurred about 10 years in the past, HIV data provide a picture of more recent infections.

- Data from provincial testing programs indicate that MSM is a decreasing factor among newly-diagnosed adult male HIV infections. For example, at the national level, MSM accounted for 47.8% of new positive tests during 1997-99 compared to 53.4% during 1995-96, and 81% prior to 1995[1].

- Data from Ontario indicate that the incidence of new HIV infections among MSM who are repeatedly tested for HIV decreased from

1.9/100 person-years in 1992 to 1.1/100 persons-years in 1996, and slightly increased to 1.5/100 person-years in 1998. Part of the explanation for these changes may be related to an increase in HIV-positive test reports for men in Ottawa-Carleton during 1997-98[2].

HIV Prevalence and Incidence Data

- During the period 1982-85, HIV prevalence among MSM was estimated at 32% in Vancouver[3], 57% in Toronto[4] and HIV incidence was estimated at 11.5% in Vancouver[3], and 7% in Toronto[4].

- In the early 1990s, a national study among MSM reported that 65% had been tested for HIV antibody and self-report prevalence rates were 18.2% nationally, 23.0% in Vancouver, 27.2% in Toronto, 20.1% in Montreal, and between 10.2% and 20.5% in other regions of Canada[5]. In another study done among MSM in Montreal in 1988, the prevalence rate was 25% and the incidence rate was 3.5%[6].

- In studies done more recently (1994-98), prevalence rates among MSM were 16% in Vancouver[7], 12% in Alberta STD patients[8], 7% in Winnipeg[9], 5.2% in Ontario MSM who underwent voluntary HIV testing[10], 1% in Ontario bisexual men (self-reported data)[11], and 4-10% in Montreal (street youth and inmates)[12,13]. Prevalence rates are higher for MSM who are also injection drug users; for example, 23-26% among MSM/IDU in Ontario[14]; 14-20% among MSM/IDU attending needle exchange programs in Quebec[15,16]

- Two ongoing cohort studies (1995-present) among MSM suggest an incidence of 0.6/100 person-years in young MSM (less than 30 years of age) and 1/100 persons-years in older MSM in Montreal[17], and an incidence of 1.1/100 person-years in MSM ages 18-30 years in Vancouver[18].

Risk Behaviour Data

- In the Montreal cohort study of MSM , 9% of participants reported engaging in unprotected anal intercourse with a casual partner in the 6 months prior to being interviewed. Unprotected anal sex in the last six months and unprotected receptive oral sex with casual known HIV-positive partner were associated with new HIV infection[17].

- In the Vancouver cohort study of MSM aged 18-30 years, 32% reported having unprotected anal intercourse with a casual partner in the year prior to baseline[18].

- Further comparison between MSM aged 18-30 years in the Vancouver cohort and the Montreal cohort found that MSM in Montreal were less likely to report currently having sex with both men and women (5% vs 12%), or unprotected anal sex with sex trade clients (4% vs 9%) or male sex workers (<1% vs 5%). However, MSM in Montreal were more likely to have more than 20 sexual partners during the previous six months (11% vs 8%)[19].

- In a comparison with a 1982-84 Vancouver cohort of MSM, the recent Vancouver cohort reported a higher mean number of male sexual partners in the previous year (15 vs 12), a higher proportion of receptive anal intercourse with casual partners (62% vs 38%) and with regular partners (92% vs 60%), but a much lower proportion of unprotected insertive anal sex with casual partners (6% vs 58%) and with regular partners (17% vs 69%). The recent cohort also reported a lower proportion of using nitrite inhalants (34% vs 43%) but a higher proportion of using cocaine (30% vs 8%), LSD (21% vs 3%) and amphetamine (11% vs 1%). After controlling for differences in age, ethnicity, substance abuse, and method of recruitment between cohort members, the older cohort were nine time more likely to report high-risk sexual behavior. Further adjustment for sexual behaviors showed the risk ratio for seroconversion among older cohort members remained significantly

elevated compared with recent cohort members[18,20].

Comment

The incidence of HIV among MSM has been decreasing since the mid-1980s, although transmission continues to occur. In 1996, the MSM exposure category comprised about 30% (1,240) of the estimated 4,200 new HIV infections that occurred during the year[21] (see *Epi Update* entitled "HIV Prevalence and Incidence in Canada"). Better data are needed to continue monitoring the epidemic in this important group and to target prevention and care programs.

References

1. Health Canada. *HIV and AIDS in Canada. Surveillance Report to December 31, 1999.* Division of HIV/AIDS Surveillance. Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000.

2. Major C, Remis R, Degazio T, Swantee C, Francis A, Galli R, Fearon M. *Shifts In The HIV Epidemic-Ontario* {Abstract C352P}. Can J Infect Dis 1999:10:55B and Proceedings of the Joint HIV/AIDS/STD Annual Surveillance Meeting (November 1999, Calgary), Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

3. Craib KJP, Strathdee SA, Hogg RS, Cornelisse PGA, Willoughby BC, Schechter MT et al. *Incidence Rates of HIV-1Infection, AIDS Progression and Mortality in the Vancouver Lymphadenopathy-AIDS Study: Results at 14 years* {Abstract 213}. Can J Inf Dis 1998;9:31A.

4. Coates R, Calzavara LM, Read SE, Fanning MM, Shepherd F, Mac Fadden DK et al. *A Prospective Study of Male Sexual Contacts of Individuals With ARC or AIDS.* Final report to National Health Research and Development Program, 1992.

5. Myers T, Godin G, Calzavara L, Lambert J, Locker D and the Canadian AIDS Society Team. *The Canadian Survey of Gay and Bisexual Men and HIV Infection: Men's Survey.* The National AIDS Clearing House, Ottawa, Ontario (Catalogue ISBN 0-921906-14-5).

6. Remis RS, Najjar M, Pass C, Paradis G. *Seroepidemiological Study of HIV Infection And Sexual Behaviour Among Men Attending a Medical Clinic in Montreal* {Abstract W.A.P.42}. Vth Int Conf on AIDS, Montreal, Canada, June 1989.

7. Low-Beer S, Weber AE, Bartholomew K, Landolt M, Oram D, Schilder A, O'Shaughnessy MV, Hogg RS. *A Demographic And Health Profile of HIV-Positive Gay and Bisexual Men in The West End of Vancouver.* Can J Infect Dis 1999;10:62B.

8. Romanowski B, Campbell P, Preiksaitis J, Fonseca K. *Human Immunodeficiency Virus Seroprevalence and Risk Behaviours In Patients Attending Sexually Transmitted Disease Clinics in Alberta.* Sexually Transmitted Diseases September 1997:487-94.

9. Myers T, Calzavara L, Major C, Marchand R, Morrison K, Allman D. *Self-reported HIV Antibody Status And Laboratory Test Results in a Community Sample of Gay and Bisexual Men: Winnipeg Men's Survey* {Abstract 326}. Can J Inf Dis 1995; 6 Suppl B:37.

10. Remis RS, Major C, Bangura H, Wallace E, Schiedel L. *Report on HIV/AIDS in Ontario, 1997-1998.* Ontario Ministry of Health, November 1999.

11. Myers T, Allman D, Strike C, Calzavara L, Millson P, Major C et al. *Bisexual Men and HIV in Ontario: Sexual Risk Behaviour With Men and With Women.* Can J Infect Dis 1997;8 Suppl A:23.

12. Roy E, Hayley N, Boivin JF, Frappier JY, Classens C, Lemire N. *Risk Factors for HIV Infection in Street Youth (SY)* {Abstract Tu.C.2629}. XIth Int Conf on AIDS, Vancouver, July 1996.

13. Dufour A, Alary M, Poulin C, Allard F, Noel L, Trottier G, Lepine D, Hankins C. *Prevalence and Risk Behaviours for HIV Infection Among Inmates of a Provincial Prison in Quebec City.* AIDS 1996; 10(9):1009-15.

14. Millson PE, Myers T, Rankin J, Major C, Fearon M, Rigby J. *Double Jeopardy: HIV infection risk in male drug injectors who also have sex with men* {Abstract 324}. Can J Infect Dis 1995;6:41B.

15. Poulin C, Alary M, Noel L, Classens C, Lachance C. *Prevalence and Incidence of HIV Among Injecting Drug Users (IDU) Attending a Needle Exchange Program NEP in Quebec City* {Abstract 218}. Can J Inf Dis 1997; 8 Suppl A:27.

16. Alary M, Hankins C, Parent R, Noel L, Claessens C, Blanchette C et al. *Le Réseau SurvUDI: quatre années de surveillance du VIH chez les utilisateurs de drogues.* Report to LCDC, November 1999.

17. Dufour A, Alary M, Remis R, Otis J, Masse B, Turmel B et al. *Gay Men Lost to Follow-Up in The OMEGA Cohort Study: Are They at Risk for HIV Infection?* {Abstract C37P}. Can J Inf Dis 1999;10:62B and Proceedings of the Joint HIV/AIDS/STD Annual Surveillance Meeting (November 1999, Calgary), Bureau of HIV/AIDS, STD and TB, LCDC.

18. Craib KJ, Weber AC, Cornelisse PGA, Martindale SL, Miller ML, Schechter MT et al. *Comparison of sexual behaviors, unprotected sex, and substance abuse between two independent cohorts of gay and bisexual men.* AIDS 2000;14(3):303-311.

19. Dufour A, Strathdee SA, Alary M, Martindale SL, Otis J, Voght R et al. *Comparison Between Young Men Who Have Sexual and Affective Relationship with Men (MSM) Participating in Two Cohort Studies in Montreal and Vancouver* {Abstract 258P}. Can J Inf Dis 1998;9:44A.

20. Martindale S, Craib KJP, Miller ML, Weber AE, O'Shaughnessy MV, Schechter MT, Hogg RS. *Temporal Changes In Seroincidence Associated With Increased Use of Condoms: Evidence from Two Independent Prospective Studies of Gay and Bisexual Men* {Abstract C322}. Can J Infect Dis 1999;10:48B.

21. Archibald CP, Remis RS, Farley J, Sutherland D. *Estimating HIV Prevalence and Incidence at The National Level: Combining Direct and Indirect Methods With Monte-Carlo Simulation.* XI International Conference on AIDS, Geneva, Switzerland, June-July 1998 {Abstract 43475}.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

HIV/AIDS Among Injection Drug Users in Canada

Introduction

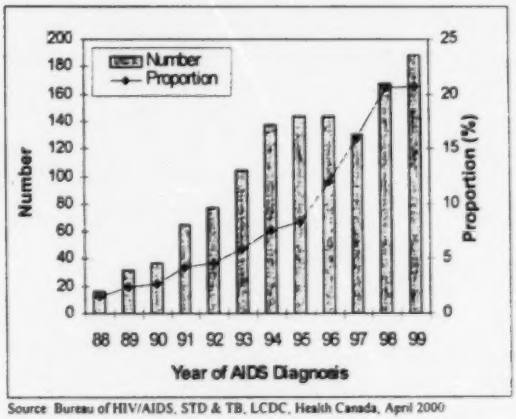
The Canadian HIV epidemic has changed significantly since the early 1980s when it was concentrated in men who have sex with men (MSM). In 1996, approximately half of the estimated 4,200 new HIV infections that occurred in Canada were among injection drug users (IDUs)[1], illustrating the significance of this group in the current Canadian epidemic. This report updates current information on the status of the HIV/AIDS epidemic among IDUs in Canada.

Injection drug use remains a high risk factor among AIDS cases

- As of December 31, 1999, 16,913 AIDS cases had been reported to the Bureau of HIV/AIDS, STD and TB[2].

- Figure 1 shows that the number and proportion of AIDS cases attributed to IDU has steadily increased over time. Prior to 1990, 1.5% of adult AIDS cases were attributed to IDUs. This proportion increased to 2.7% in 1990, 8.4% in 1995, and 20.6% in 1998. In 1999, 50 (20.7%) adult AIDS cases were attributed to injection drug use and an additional 14 (5.6%) were attributed to the combined category of injection drug use and MSM[2].

Figure 1: Annual AIDS reports among IDU, annual number adjusted for reporting delay and percentage of adult cases.



Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

- Although the proportion of AIDS cases attributed to injection drug use has increased over time among both males and females, among women, this increase has been dramatic: from 7.3% prior to 1990, to 15.5% in 1990, 25.2% in 1995 and 43.8% in 1998. In 1999, 31.7% of AIDS cases in females were among IDUs[2]. For males, injection drug use accounted for 18.5% of AIDS cases in 1999, compared to 1.1% prior to 1990, 2.2% in 1990, 6.9% in 1995, and 16.1% in 1998. The proportion of male AIDS cases associated with MSM/IDU was 3.7% prior to 1990, 5.8% in 1995, 4.4% in 1998 and 7% in 1999[2].

No significant decline in the proportion of HIV positive test reports among IDUs

- As of December 31, 1999, 45,534 positive HIV tests had been reported to LCDC[2]. Of the 44,929 cases reported among adults, 3,472 (15.3%) were attributable to injection drug use and an additional 515 (2.3%) were attributed to the combined category of injection drug use and MSM.

- The proportion of positive HIV test reports attributed to IDUs has increased from 8.9% between 1985-94 to 29.8% in 1995 and 33.8% in 1996. This proportion has remained high but relatively stable in 1997 and 1998 (33% and 28.4%, respectively). In 1999, 315 (28.3%) HIV test reports were among IDUs[2].

- The data from provincial HIV testing programs support the national trends indicating a high but stable proportion of new HIV diagnoses among IDUs. In Ontario, in 1998-99, 6.4% of new HIV diagnoses were among IDUs[2], compared to 5.7% between 1996-97, 5.4% in 1995 and 2.8% prior to 1995[3]. The situation is even more marked in B.C., where injection drug use accounted for 36.6% of new HIV diagnoses in 1998-99[2], compared to 43% in 1996-97, 38% in 1995 and 8.2% prior to 1995[3].

HIV prevalence and incidence remain unacceptably high among injection drug users.

- The SurvIDU study which has been ongoing since 1995 consists of seven centres providing needle exchange services to IDUs in the province of Quebec, plus Ottawa. Results from 1999 suggest the overall prevalence of HIV was 14.4%[4]. HIV prevalence among IDUs remains high in urban centres (10% in Quebec City, 18.1% in Montreal, 20.5% in Ottawa-Hull, 19% in Outaouais) and 4% in semi-urban centres. Overall HIV incidence rate in 1999 was 5.4 per 100 person-years (PY). Montreal and Ottawa had the highest rates, at 7.7 and 7.6 per 100 PY respectively, Quebec City had a rate of 3.7 per 100 PY, and in semi-urban areas the rate was 1.8 per 100 PY[4,5]. The HIV incidence in 1999 among the St. Luc Cohort in Montreal was about 4%[5,6].

- Results from the Ontario seroprevalence study at needle exchange sites found an overall HIV prevalence among IDUs in 1997-98 was 6.5% (5.8% among men and 9.4% among women) with a range from 8.3% (Toronto) to 14.6% (Sudbury and Thunder Bay)[7,8]. Needle sharing occurred among 36% of participants in Toronto; 46% of participants in Niagara/Hamilton, London/Windsor and Kingston, and 41% of participants in Sudbury/Thunder Bay[7,8].

- Results from the Vancouver Injection Drug Use Study found a sharp increase in HIV incidence, of 20 per 100 PY during the first follow-up in 1997 Since the second follow-up at the end of 1997 the incidence has been fairly steady at 2-3 per 100 PY annually[9-11].

- Results from the Calgary Needle Exchange Program, Safeworks, showed the prevalence of HIV among IDUs has increased from 2.2% in 1992 to 3.3% in 1998[12,13].

- Results from the Winnipeg Injection Drug Epidemiology (WIDE) Study found that the prevalence of HIV infection among IDUs has increased significantly from 2.3% in 1986-90 to 12.6% in 1998[14].

Women, Youth, Aboriginal Groups and Prisoners are particularly at risk for HIV infection through injection drug use

- Since 1995, almost half of all new HIV test reports among women can be attributed to injection drug use. In 1998, 37.3% of newly reported HIV diagnoses among women was attributed to injection drug use versus and 25.7% among men. In 1999 46.1% and 22.9% of new HIV diagnoses were attributed to injection drug use among women and men, respectively[2].

- HIV prevalence and incidence data show a high risk for infection with HIV among street youth and youth who inject illicit drugs (see *EpiUpdate* entitled "HIV and AIDS among Youth in Canada").

- Aboriginal peoples are over-represented in inner city injection drug use communities and among clientele using inner-city services such as needle exchange programs and counseling/referral services. (see *EpiUpdate* on "HIV and AIDS among Aboriginal People in Canada").

- IDUs are over-represented in prisons. Estimates of HIV prevalence among prisoners vary from one to four percent in men and from one to 10% in women, and in both groups infection is strongly associated with a history of injection drug use.[15-18] A study in a Canadian federal penitentiary found that in 1998, 1.7% of inmates were HIV positive (1% in 1995) and 24.3% reported injecting in prison (12.0% in 1995)[19].

Comment

The HIV epidemic among IDUs in Canada continues to be a very serious problem, with the infection spreading in vulnerable populations and across geographic boundaries. Although the problem is best documented in larger cities, increasingly, it is now being seen outside major urban areas. Additional epidemiologic data are needed to better define the extent of the problem and to guide the development and refinement of effective prevention policies and programs. These data are especially needed for areas outside major urban areas and for Aboriginal populations. Given the geographic mobility of IDUs and their social and sexual interaction with non-users, the dual problem of injection drug use and HIV infection is one that ultimately affects all of Canadian society.

References

1. Archibald CP, Remis RS, Farley J, Sutherland D. *Estimating HIV prevalence and incidence at the national level: combining direct and indirect methods with Monte-Carlo simulation.* XII International Conference on AIDS, Geneva, June-July 1998 (Abst. 43475).

2. Health Canada. *HIV and AIDS in Canada. Surveillance Report to December 31, 1999.* Division of HIV/AIDS Epidemiology. Bureau of HIV/AIDS, STD and TB, LCDC, HPB, Health Canada, April 2000.

3. Health Canada. *HIV in Canada: Surveillance of HIV positive test reports for the period 1985-1996.* Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, 1997.

4. Alary M. *Overview of HIV among IDUs in Quebec - The SurvIDU study.* Proceedings of the Joint HIV/AIDS and STD Meeting in Calgary, November 17-20, 1999. Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

5. Tannenbaum T. *Overview of HIV among IDUs in Quebec - The HIV and AIDS surveillance program.* Proceedings of the Joint HIV/AIDS and STD Meeting, Calgary, November 17-20, 1999. Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

6. Lamothe F. *Overview of HIV among IDUs in Quebec - The St. Luc Cohort Study on IDUs.* Proceedings of the Joint HIV/AIDS and STD Meeting, Calgary, November 17-20, 1999. Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

7. Wallace E. *Overview of HIV among IDUs in Ontario - The HIV and AIDS surveillance program.* Proceedings of the Joint HIV/AIDS and STD Meeting, Calgary, November 17-20, 1999. Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

8. Millson PE, Myers T, Calzavara L, Major C, Fearon M, Rea E, Wallace E. *Inventory of HIV Incidence/Prevalence Studies in Canada, April 2000.* Produced by the Division of HIV Epidemiology, Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

9. Tyndall M. *Overview of HIV among IDUs in B.C. - VIDUS.* Proceedings of the Joint HIV/AIDS and STD Meeting, Calgary, November 17-20, 1999. Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

10. Patrick DM, Schechter MT, Strathdee SA, Cornelisse PGA, Rekart ML, Cook D, Montaner JSG, O'Shaughnessy MV. *HIV Incidence in Vancouver IDUs follows a Predictable Decline.* Seventh Annual Canadian Conference on HIV/AIDS, Quebec, 1998: Can J Inf Dis 1998. 9 (Suppl A):#270P

11. Schechter MT, Strathdee SA, Cornelisse PGA, Currie S, Patrick DM, Rekart ML, O'Shaughnessy MV. *Do needle exchange programmes increase the spread of HIV among injection drug users?: an investigation of the Vancouver outbreak.* AIDS 1999;13:F45-51.

12. Wheeler V. *Overview of HIV among IDUs in Alberta - Safeworks Needle Exchange Program in Calgary.* Proceedings of the Joint HIV/AIDS and STD Meeting, Calgary, November 17-20, 1999. Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada.

13. Guenter D. *Calgary Needle Exchange Clients: HIV prevalence, demographics, behaviours.* Final Report of a Survey. June-September, 1998.

14. Elliot LJ, Blanchard JF, Dinner KI, Dawood MR, Beaudoin C. *The Winnipeg Injection Drug Epidemiology (WIDE) Study.* Eighth Annual Canadian Conference on AIDS, Vancouver BC May 1-4 1999. Can J Infectious Diseases 1999; 10 (suppl B): C314

15. Rothon DA, Mathias RG, Schechter MT. *Prevalence of HIV infection in provincial prisons in B.C.* 7th Annual B.C. Conf, Vancouver, October 1993 (Conference Syllabus, 229-236). Can Med Assoc J 1994; 151(6):781-87.

16. Calzavara L, Major C, Myers T, Millson M, Wallace E, Fearon M, et al. *Reducing volunteer bias: using left-over specimens to estimate rates of HIV infection among inmates in Ontario, Canada.* AIDS 1995;9:631-7.

17. Hankins CA, Gendron S, Lai-Tung MT, Handley M, O'Shaughnessy M. *HIV and women in prison: assessment of risk factors using a non-nominal methodology.* Am J Public Health 1994; 84:1637-40.

18. Hankins CA, Gendron S, Tran T, Lai-tung MT, Paquette N, Jalbert M, Gomez B, Roy J. *Prior risk factors for HIV infection and current risk behaviours among incarcerated men and women in medium security correctional institutions - Montreal.* Fifth Annual Canadian Conference on HIV/AIDS Research, Winnipeg, 1995; Can J Inf Dis 1995, 6 (Suppl B): 56B, #311.

19. Ford P, Pearson M, Stevenson T, Bell D, Sankar P, Austen. *Risk Behaviour in a Canadian Federal Penitentiary - Association with hepatitis C and HIV seroprevalence.* Eighth Annual Canadian Conference on HIV/AIDS Research, Vancouver, 1999; Can J Inf Dis 1999, 10 (suppl B): C385P

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

Risk Behaviours Among Injection Drug Users in Canada

Introduction

The proportion and number of AIDS cases and estimated HIV infections attributable to injection drug use in Canada have been increasing steadily since the beginning of the HIV epidemic in the early 1980s (see *Epi Update* entitled "HIV/AIDS Among Injection Drug Users in Canada"). In 1996, approximately half of the estimated 4,200 HIV infections that occurred in Canada were among injection drug users (IDUs),[1] illustrating the significance of this group in the Canadian epidemic. This report briefly describes the drug injection and sexual risk behaviours seen among IDUs in this country. Needle exchange programs, an important part of the strategy to reduce HIV transmission among drug injectors in Canada, are also discussed.

Neither a Borrower Nor a Lender Be: Sharing of Needles and Other Injection Equipment

The sharing (borrowing and lending) of needles and syringes is well-established as a means of HIV infection and is relatively common among IDUs:

- A recent study in Prince Albert, Saskatchewan found that 42.6% of IDUs had borrowed used needles from a drug injecting peer in the past six months.[2]
- Among IDUs recruited from needle exchange programs (NEPs) in Ottawa and the province of Quebec, 40.2% reported needle borrowing and 36.2% reported needle lending in the six months prior to the study.[3]
- In a 1998 study of IDUs from Winnipeg, 42% reported injecting with a needle in the last year that had been used by someone else.[4]

The sharing of other injection equipment (e.g., spoons/cookers, filters, and water), often referred to as "indirect sharing," may also be associated with HIV seroconversion. Research suggests that indirect sharing occurs more frequently among IDUs than does multi-person use of needle/syringes:

- A 1996-1998 study of Ottawa NEP attendees reported that 42% shared injection equipment other than needles in the past six months, with 20% sharing only injection paraphernalia.[5]
- In a 1995 case-control study of NEP attendees in British Columbia, 69% of participants reported indirect sharing. This behaviour was higher among those who borrowed needles (83%) compared to those who did not admit to needle borrowing (53%).[6]
- International studies[7,8,9] of IDUs have identified other aspects of drug injection, such

as "front-loading" or "back-loading", that may also increase the risk of HIV transmission (This is a practice where two or more IDUs use only one syringe to prepare a drug solution. The solution is then squirted into one or more additional syringes either via the front of the recipient syringe after removing its needle (front-loading), or via the back after removing the plunger (back-loading)). However, the full extent of such risk behaviours among Canadian IDUs is still under investigation.

Needle Exchange Programs (NEPs): Good but Not a Panacea

- NEPs have been aptly described as a focal point for intervention. In addition to distributing sterile injection equipment, NEPs are a useful way of getting in touch with IDUs in order to educate and counsel them, and to connect this hard-to-reach population to health care services and drug treatment programs.

- Contrary to the arguments raised by some opponents of needle exchange, there is evidence that NEPs do not increase the number of IDUs in a region or city or lower the age of first injection [10,11] Recent research also shows that needle exchanges do not increase the number of needles discarded in a community or change the locations where needles are disposed.[12]

- Research suggests that NEPs attract IDUs at relatively high risk for HIV infection. In Vancouver, IDUs who were frequent NEP attendees were more likely to report unstable housing and hotel living, frequent cocaine injection, sex trade involvement, injecting in "shooting galleries," and incarceration in the last six months than were non-frequent attendees.[13,14]

- A recent Montreal study estimated the number of syringes that would have had to have been available if all of that city's IDUs were to have used a sterile needle for each injection throughout 1994, and compared this figure with the number of syringes distributed by NEPs or sold by pharmacies during that year. The results showed that less than 5% of the need for sterile needles among IDUs in that city was actually met.[15]

- Most international studies report substantial declines in needle sharing among IDUs who use NEPs. [16] However, some researchers have found no difference in sharing behaviours between attendees and non-attendees or have found greater declines in injection risk behaviours among IDUs who do not use such programs.[17,18]

- Despite concerns by some that NEPs may exacerbate the spread of HIV among IDUs, a growing body of research indicates that this is not, in fact, the case.[13,19] Although some studies have indeed reported an increased HIV prevalence and incidence among NEP attendees[20], this is likely due to the fact that NEP attendees are higher risk IDUs than are non-attendees.[13,19,21]

Risky Business: Trading Unprotected Sex for Money and Drugs

Many IDUs in Canada are involved in unprotected commercial sex:

- Among NEP attendees in Ottawa and the province of Quebec, 46% of women had had sex trade clients in the past six months. Among all sexually active female IDUs, only 19.2% were consistent condom users.[3]

- In a Winnipeg study, 71.5% of female IDUs and 30.2% of male IDUs reported that they had ever been paid for sex. Among females, 25% used condoms inconsistently with their sex trade clients. Among men with male clients, 52% reported inconsistent condom use.[4]

Not Safe Enough: Sex with Regular and Casual Partners

Among IDUs with regular and casual opposite-sex partners, condom use is also low:

- Among IDUs in Winnipeg, 68% of women and 57% of men who had had regular partners in the past year reported that they never used condoms. Of those who reported having had casual partners in this time period, approximately 30% of both men and women never used condoms.[4]

- According to a study conducted in Vancouver in 1995, only 60% of women and 51% of men who had casual sexual partners used condoms more than 75% of the time.[13]

Same Sex Partners and Male IDUs

A substantial minority of male IDUs report sexual intercourse with same sex partners:

- Among IDUs recruited from NEPs in Quebec and Ottawa, 13% of men had had male partners in the past six months with few reporting consistent condom use.[3]

- Of men who took part in a Winnipeg IDU study, 22.6% reported that they had ever had sex with males.[4]

Injection Drug Use Is a Problem among Street Youth and Prisoners

Appropriate and accessible HIV prevention programs for drug injecting street youth and inmates are clearly needed:

- One-third of a sample of Montreal street youth had injected drugs in the previous six months. Among those who were regular injectors, 47% had shared needles in this time frame.[22]

- Among female prisoners in a Quebec prison, 38% reported injecting drugs before they were incarcerated, and about half of these women had shared needles. Of those who reported drug injection before going to prison, 11% admitted to injecting drugs during their incarceration, and most (80%) shared needles.[23]

- Among male prisoners in this same study, 26% reported that they had injected drugs before being incarcerated, and about half of these had shared needles. Of those who admitted to injecting drugs outside prison, 2% reported injection drug use during their incarceration, and most (92%) shared needles.[23]

Comment

High-risk needle sharing and sexual behaviours continue to fuel the HIV epidemic among IDUs in Canada, and this group now accounts for about half of new infections in this country. Continued monitoring of risk behaviours among IDUs and of factors associated with these behaviours is critical, especially with respect to trends over time. This information is needed to help guide and evaluate prevention programs that target drug injectors. At present, there is a huge gap between IDU need and the number of sterile syringes currently being distributed by NEPs. This issue must be addressed to help make a "one hit one fit" policy more realistic.[24] Although NEPs are an integral part of Canada's HIV prevention strategy for IDUs, exchange programs alone are likely not sufficient to reduce or prevent HIV transmission in this subgroup of the population.[13,22] NEPs must be complemented by appropriate and accessible health and social services, detoxification, and drug treatment programs.

References

1. Archibald CP, Remis RS, Farley J, Sutherland D. *Estimating HIV prevalence and incidence at the national level: combining direct and indirect methods with Monte-Carlo simulation.* XII International Conference on AIDS, Geneva, June-July 1998 (Abstract 43475).

2. Siushansian J, Vooght M, Archibald CP, Young E, Bangura H, Hudson S, Horsman G, Lior LY, Allen M, Whitehead S, Nowgesic E, Sutherland D. *The Prince Albert Seroprevalence Study (PASS).* Division of HIV Epidemiology, Division of HIV/AIDS Surveillance, and Division of STD Prevention and Control Annual Meeting, Calgary, November 1999.

3. Hankins C, Parent R, Alary M, Noel L, Blanchette C, Claessens C, and the SurvIDU Working Group. *Risk factors associated with HIV infection in the SurvIDU.* Paper presented at 8th Annual Canadian Conference on HIV/AIDS Research, Victoria, May 1999; Can J Inf Dis 1997; 10 (Suppl A): 44B #C309.

4. Elliott L, Blanchard J, Dawood M, Beaudoin C, Dinner K. *The Winipeg injection drug epidemiology (W.I.D.E.) study: A study of the epidemiology of injection drug use and HIV infection in Winnipeg, Manitoba.* Final Report submitted to the Division of HIV Epidemiology, LCDC, 1999.

5. Leonard, L, Hansen, J, Hotz, S. *The vulnerable 20%: A shift towards injection drug users who engage in indirect sharing.* Paper presented at 8th Annual Canadian Conference on HIV/AIDS Research, Victoria, May 1999; Can J Inf Dis 1997; 10 (Suppl A): 60B #C368P.

6. Strathdee S, Patrick D, Archibald CP, Ofner M, Cornelisse P, Rekart M, et al. *Social determinants predict needle-sharing behaviour among injection drug users in Vancouver, Canada.* Addiction 1997; 92: 1339-1347.

7. Koester S. *Following the blood: Syringe re-use leads to blood-borne virus transmission among injection drug users.* J Acq Imm Defic Synd and Hum Retrovirol 1998 Jul; 18(Suppl 1): S139.

8. Greenfield L, Bigelow G, Brooner R. *HIV risk behaviour in drug users: Increased blood "booting" during cocaine injection.* AIDS Educ Prev 1992 Summer; 4(2): 95-107.

9. Needle R, Coyle S, Cesari H, et al. *HIV risk behaviour associated with the injection process: multiperson use of drug injection equipment and paraphernalia in injection drug user networks.* Subst Use Misuse 1998 Oct; 33(12): 2303-2423.

10. Lurie P, Reingold A, Bowser B et al. *The public health impact of needle exchange programs in the United States and abroad: Summary, conclusions, and recommendations.* School of Public Health, University of California, Berkely, and Institute for Health Policy Studies, University of California, San Francisco, October 1993.

11. Guydish J, Bucardo J, Young M, Woods W, Grinstead O, Clark W. *Evaluating needle exchange: Are there negative effects?* AIDS 1993; 7, 871-876.

12. Vlahov D, et al. *Needle exchange programs don't increase prevalence of discarded needles.* Am J Epidemiol 1997.

13. Schecter MT, Strathdee SA, Cornelisse PGA, Currie S, Patrick DM, Rekart ML, O'Shaughnessy MV. *Do needle exchange programmes increase the spread of HIV among injection drug users?: an investigation of the Vancouver outbreak.* AIDS. 1999; 13 F45-F51.

14. Archibald CP, Ofner M, Strathdee SA, Patrick DM, Sutherland D, Rekart ML, Schechter MT, O'Shaughnessy MV. *Factors associated with frequent needle exchange program attendance among injection drug users in Vancouver, Canada.* J Acquir Immune Defic Syndr Human Retrovirol 1998;17:160-6.

15. Remis R, Bruneau J, Hankins C, et al. *Enough sterile syringes to prevent HIV transmission among injection drug users in Montreal?* J Acq Immun Defic Syndr and Hun Retrovirol. 1998; 18(Suppl 1): S57-S59.

16. Watters JK, Estilo MJ, Clark GL, Lorvick J. *Syringes and needle exchanges as HIV/AIDS prevention for injection drug users.* JAMA 1994; 271: 115-120.

17. van Ameijden EJC, van den Hoek JAR, Coutinho RA. *Injecting risk behaviour among drug users in Amsterdam, 1986 to 1992, and its relationship to AIDS prevention programs.* Am J Public Health 1994; 84: 275-281.

18. Donoghoe MC, Dolan KA, Stimson GV. *Changes in injectors' HIV risk behaviour and syringe supply in UK, 1987-90.* Final program and abstracts of the Seventh International Conference on AIDS. Florence, Italy, 1991.

19. Des Jarlais DC, Marmor M, Paone D, Titus S, Shi Q, Perlis T, Jose B, Friedman SR. *HIV incidence among injecting drug users in the New York City syringe-exchange programmes.* Lancet 1996;348:987-91.

20. Bruneau J, Lamothe F, Franco E, Lachance N, Desy M, Soto J, Vincelette J. *High rates of HIV infection among injection drug users participating in needle exchange programs in Montreal: results of a cohort study.* Am J Epidemiol 1997; 146: 994-1002.

21. Lowndes CM, Alary M. Letter to Editor re: *High rates of HIV infection among injection drug users participating in needle exchange programs in Montreal: results of a cohort study.* Am J Epidemiol 1998;148:713-4.

22. Roy E, Haley N, Boivin J, Frappier J, Claessens C, Lemire N, Fournier L. *Injection drug use among street youth: A dynamic process.* Paper presented at 6th Annual Canadian Conference on HIV/AIDS Research, Ottawa, May 1997; Can J Inf Dis 1997; 8 (Suppl A): 29A #225.

23. Dufour A, Alary M, Poulin C, Allard F, Noel L, Trottier G, Lepine D, Hankins C. *Prevalence and risk behaviours for HIV infection among inmates of a provincial prison in Quebec City.* AIDS 1996;10:1009-15.

24. Hankins CA. *Syringe exchange in Canada: Good but not enough to stem the tide.* Subst Use Misuse 1998; 33(5): 1129-1146.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

Oral Sex and the Risk of HIV Transmission

Introduction

The risk of HIV transmission through unprotected anal and vaginal intercourse is well known. Estimates of the per-sex-act probability of HIV transmission among homosexual men in the U.S. through receptive penile-anal intercourse with ejaculation range from 0.005-0.03 during the asymptomatic phase of infection and the period leading to AIDS[1] to as high as 0.1-0.3 during primary HIV infection.[2] Analyses of data from North American and European studies of long-term heterosexual couples estimate the per-sex-act probability of HIV transmission through penile-vaginal intercourse to be approximately 0.001.[3] However, the independent risk of HIV transmission through orogenital contact has been more difficult to study and is less well understood. This report updates current information on oral sex and the risk of HIV transmission. Current recommendations on the use of condoms for oral intercourse are also reviewed.

Laboratory and Animal Studies Suggest that HIV Infection through Oral Sex May Occur

- A recent animal study found that the minimal dose of simian immunodeficiency virus (SIV) (a virus closely related to HIV-1) required to achieve infection in adult rhesus monkeys through oral exposure was 6,000 times lower than was the minimal dose needed to achieve infection after rectal exposure. The researchers concluded that as with oral exposure to SIV by rhesus monkeys, oral exposure to HIV-1 by humans likely carries the risk of infection.[4]

- In a laboratory study designed to explore the oral transmission of HIV by seminal fluid and colostrum, normal donor samples of human milk, colostrum, seminal fluid, and blood were separately combined with samples of saliva and HIV-infected white blood cells. All samples, in normal physiologic volumes, prevented saliva from inactivating the HIV infected blood cells, leading the researchers to conclude that successful oral transmission of HIV by seminal fluid, milk, and colostrum may occur.[5]

Oral Sex Between Homosexual Males: Not as Safe as Previously Perceived

Several epidemiological studies have examined the risk of HIV infection through unprotected receptive oral intercourse (receptive fellatio).

- In a 1996-1999 study of 102 homosexual men recently diagnosed with HIV infection, it was found that approximately 7% of cases likely occurred as a result of receptive oral sex.[6]

- In a 1986-1988 prospective study of HIV infection and AIDS among homosexual men in the Netherlands, four of 102 cases of

seroconversion were identified as probably being a result of receptive oral intercourse.[7]

- In a study of newly diagnosed HIV-infected gay men, six of 37 patients who had been infected within a year before testing claimed only receptive oral sex as the possible route of their infection. [8]

Several studies have also explored the possibility of HIV transmission through unprotected insertive oral intercourse (insertive fellatio or anilingus).

- In a prospective study of HIV infection among homosexual men in the Netherlands, five of 102 seroconverters may have been infected through insertive orogenital or anogenital intercourse. [7]

- In an early cohort study of homosexual men, two of five cases of HIV seroconversion were attributed to oral insertive intercourse. [9]

Additional studies, while not distinguishing the type of oral sex between homosexual men, further suggest the possibility of HIV transmission though oral-penile/oral-anal contact.

- In a study to describe the clinical and epidemiologic features of primary HIV infection, four of 46 patients reported having had only unprotected orogenital contact during the sexual encounter that led to their seroconversion. [10]

- In a 1987 study[11] of 741 homosexual men in the Netherlands, orogenital contact alone was identified as a risk for HIV acquisition, although this result was not statistically significant.

- In a 1987 U.S. study, homosexual males who were participating in a hepatitis B study were found to have a higher risk of HIV infection from both orogenital and oroanal contact. [12]

Female-to-Female Transmission of HIV through Oral Intercourse: Truth or Bias?

- To date, there have been reports of HIV transmission through orogenital contact between lesbians (cunnilingus).[13] Several researchers have suggested, however, that bisexual activity may be under-reported by gay women and that not all of the documented cases of female-to-female transmission of HIV infection are authentic. [14]

Case Reports Suggest Possible Transmission of HIV between Heterosexual Partners as a Result of Oral Sex

- There are several reported cases in the literature of women who acquired HIV infection after performing oral sex on their seropositive male partner (receptive fellatio). [15]

- Cases of infection in men following oral sex with their female partners have been reported, including one in which a man was infected by fellatio from a prostitute. [16,17]

Oral Lesions: A Possible Co-Factor for HIV Transmission during Oral Sex

In a 1996 cross-sectional study of crack cocaine smokers, oral sores were associated with HIV infection among persons who reported receptive oral sex.[18]

A 1993 study of female sex trade workers found that crack users who inconsistently used condoms when performing oral sex on their clients were more likely to be infected with HIV than were those who consistently used condoms when performing fellatio.[19]

Existing Views on the Risk of Transmission from Oral Sex and the Use of Condoms to Prevent Infection

The Canadian AIDS Society (CAS) currently classifies insertive fellatio between men as having a negligible risk of HIV transmission regardless of

condom use. Receptive fellatio between men is classified as having negligible risk if a condom is used and as low risk if a condom is not used (whether or not semen is taken in the mouth). CAS cautions that the risk of transmission from receptive fellatio is increased if lesions or sores are present in the mouth.[20]

With respect to insertive cunnilingus between men and women, CAS regards this practice as having a negligible risk of HIV transmission if a barrier is used, and as low risk if no barrier is used (regardless of menstrual status). Receptive cunnilingus between men and women is regarded as having a negligible risk.[20]

Both insertive and receptive anilingus with or without a barrier between men or between men and women are currently viewed by CAS as having a negligible risk of HIV transmission.[20]

CAS emphasizes that the risk of HIV transmission (or other STDs) from any of these types of oral intercourse can be effectively reduced by the proper use of a latex barrier (condom or dental dam) and thus advocates the avoidance of unprotected orogenital or oroanal contact.[20]

Conclusion

The risk of HIV transmission through oral sex is difficult to assess due to the fact that HIV seroconverters may under-report other higher risk sexual practices. Despite the relative lack of available information, the findings reported here support the recommendation that has already been made regarding the avoidance of unprotected oral sex.

References

1. DeGruttola V, Seage GR III, Mayer KH, Horsburgh CR. *Infectiousness of HIV between male homosexual partners.* J Clin Epidemiol 1989, 42: 849-856.

2. Jacquez JA, Koopman JS Simon CP, Longini IM Jr. *Role of the primary infection in epidemics of HIV infection in gay cohorts.* J Acquir Immune Defic Syndr 1994, 7: 1169-1184.

3. Mastro TD, de Vincenzi I. *Probabilities of sexual HIV-1 transmission.* AIDS 1996, 10 (Suppl A):S75-S82.

4. Baba TW, Trichel AM, An L, Liska V, Martin LN, Murphey-Corb M, and Ruprecht RM. *Infection and AIDS in adult macaques after non-traumatic oral exposure to cell-free SIV.* Science 1996; 272:1486-1489.

5. Baron S, Poast J, Richardson J, Nguyen D, Cloyd M. *Oral transmission of human immunodeficiency virus by infected seminal fluid and milk: A novel mechanism.* The Journal of Infectious Diseases 2000; 181: 498-504.

6. Hecht F, et al. *San Francisco: Oral sex associated with 7.8% of new HIV infections in study population.* 7th Conference on Retroviruses and Opportunistic Infections. San Francisco, January 30th-February 2nd, 2000 (abstract 473).

7. Keet IPM, van Lent NA, Sandfort TGM, Coutinho RA, and van Griensven GJP. *Orogential sex and the transmission of HIV among homosexual men.* AIDS 1992; 6(2):223-226.

8. Grutzmeir S, Bratt G, Ramstedt G, et al. *HIV transmission in gay men in Stockholm 1990-1992.* 1993 International Conference on AIDS (abstract PO-CO2-2584).

9. Rozenbaum W, Gharakhanian S, Cardon B, Duval E, Coulaud JP. *HIV transmission by oral sex.* Lancet 1988, i: 1395.

10. Schacker T, Collier AC, Hughes J, Shea T, and Corey L. *Clinical and epidemiologic features of primary HIV infection.* Ann Intern Med 1996; 125(4):257-264.

11. van Grievsen GJP, Tielman RAP, Goudsmit J, et al. *Risk factors and prevalence of HIV antibodies in homosexual men in the Netherlands.* Am J Epidemiol 1987, 125: 1048-1057.

12. Darrow WW, Echenberg DF, Jaffe HW, et al. *Risk factors for human immunodeficiency virus (HIV) infections in homosexual men.* Am J Public Health 1987, 77: 479-83.

13. Perry S, Jacobsberg L, Fogel K. *Orogenital transmission of human immunodeficiency virus.* Ann intern Med 1989, 111: 951-952.

14. Edwards S, Carne C. *Oral sex and the transmission of STIs.* Sex Transm Inf 1998, 74: 6-10.

15. Puro V, Narciso P, Girardi E, et al. *Male to female transmission of human immunoideficiency virus by orogenital sex.* Euro J Clin Microbial Infect Dis 1991, 10:47.

16. Spitzer PG, Weiner NJ. *Transmission of HIV infection from a woman to a man by oral sex.* [letter]. New Eng J Med 1989, 320: 251.

17. Quarto M, Germinario C, Troiano T, Fontana A, Barbuti S. *HIV transmission by fellatio.* [letter]. Eur J of Epidem 1990, 6: 339-340.

18. Faruque S, Edlin BR, McCoy CB, Word CO, Larsen SA, Schmid DS, Von Bargen JC, and Serrano Y. *Crack cocaine smoking and oral sores in three inner-city neighbourhoods.* J Acquir Immun Defic Syndr and Human Retrovir 1996; 13:87-92.

19. Wallace JI, Weiner AP. *Intravenous drug use, inconsistent use, and fellatio in relationship to crack smoking as risky behaviour for acquiring HIV among streetwalkers, New York City, April 1989-December 1993.* HIV Infected Women's Conference, February 22-24, 1995 (abstract S62).

20. Canadian AIDS Society. *HIV transmission: Guidelines for assessing risk. A resource for educators, counsellors, and health care providers.* 1999, Ottawa.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

HIV Strain Surveillance in Canada

Introduction

The human immunodeficiency virus (HIV) is among the most genetically variable of human pathogens. Two major factors contribute to this genetic diversity: the error-prone activity of reverse transcriptase, which is estimated to introduce an average of one error per genome per replication cycle[1], and recombination, which occurs at a rate of about 2% per kilobase per replication cycle[2].

Two types of HIV virus have been characterized in humans, HIV-1 and HIV-2. HIV-1 can be divided into three major phylogenetic groups: "M" (major), "O" (outlier) and more recently, group "N" (new)[3]. The vast majority of isolates cluster in the "M" group. Based on sequencing the envelope gene *(env)* ten phylogenetic subtypes (A to J) have been identified within this group, with subtypes A to E being the most common[4] (subtype E is also referred to as recombinant A/E). HIV-2 is less common than HIV-1 and is mainly found in West Africa.

Canadian HIV Strain and Drug Resistance Surveillance Program

The Canadian HIV Strain and Drug Resistance Surveillance Program (CHSDRSP) was initiated as an integrated group of projects aimed at enhancing the national surveillance of HIV. One of the central goals of this program is to conduct the systematic surveillance of HIV subtypes in Canada[5]. Through a collaborative approach between the provinces, territories and the Bureau of HIV/AIDS, STD and TB (BHST) at LCDC, laboratory samples (serum from newly diagnosed HIV-positive individuals or plasma taken for the purpose of first viral load testing) and corresponding epidemiological data are sent from the Provincial Health Laboratories to the BHST. The results are shared with key stakeholders including the provinces and territories when completed.

Why conduct HIV strain surveillance?

Improve HIV diagnostics and screening strategies

- The broad genetic diversity of HIV has implications for the ability of diagnostic tests to reliably detect circulating HIV strains. Based on the knowledge of circulating HIV subtypes and extensive laboratory testing of samples from individuals with unusual clinical presentations and/or unusual serological, PCR, or viral culture results, modifications can be made in current tests to ensure that all HIV positive persons are detected upon testing. This is also relevant for ensuring the safety of the blood supply since the tests used for screening donated blood should be able to detect circulating HIV variants.

Inform vaccine development

- HIV-1 vaccine candidates, like most HIV diagnostic tests, have been based on subtype B. The efficacy of these vaccines may be strain or subtype specific. It is therefore important to know the distribution of the viral subtypes in order to determine the effectiveness of proposed vaccines and to target future vaccine development and testing.

Assess HIV transmission patterns

- Epidemiological transmission patterns and the effect of genetic and phenotypic differences in HIV that may affect transmissibility need to be further explored. Although some studies suggest lower rates of sexual and maternal transmission of HIV-2 compared to HIV-1[6-9], other studies do not note such differences[10,11]. And although the increased proportion of new infections due to HIV-1 subtype E compared to subtype B in Thailand[12] has led to the hypothesis that subtype E may be transmitted more easily through heterosexual contact, this has not been confirmed[13]. Knowing the distribution of strains and subtypes in Canada will help to assess the implications of any differences in transmissibility between strains. The public health implications of such findings, including prevention and treatment strategies, are of special interest.

Assess HIV pathogenesis and progression of HIV-related diseases

- Although the rate of HIV-related disease progression is affected by many factors including host factors, the evidence suggests that the immunologic responses may be less suppressed by HIV-2 than by HIV-1[14,15]. It is not clear whether these are any differences in pathogenicity between HIV strains and this area needs further investigation.

Distribution of HIV-1 subtypes in Canada

Existing studies on high-risk populations suggest that HIV-1 subtype B is the most common subtype found in the country.

- In 1999, all HIV-1 sequences analysed among infected injection drug users (n=17) and men who have sex with men (n=5) residing in Montreal[16] were of subtype B.

- As of November 1999, all samples of 17 recent seroconverters and matched negative controls in Ontario belong to subtype B[17].

- In 1998, serological samples from 31 HIV positive persons of both genders, representing approximately 25% of known HIV positive persons in Newfoundland, were all of HIV-1 subtype B[18].

Despite the predominance of B subtypes, non-B subtypes of HIV-1 have been reported in Canada.

- As early as 1995, HIV-1 subtype A was reported in an African born male who moved to Canada in 1983[19]

- The BC Centre for Excellence in HIV/AIDS has conducted genetic analyses of HIV linked to cohort studies and to the BC HIV drug treatment program. These studies suggest that non-B subtypes in BC represent at least 4% of HIV infections among individuals starting therapy[20]. HIV-1 subtypes A, C, and D have been identified.

- Preliminary results from five pilot sites in CHSDRSP, which monitors the genetic diversity of HIV in Canada[5], show that 8.9% of the sampled population (n=350) were infected with non-B subtypes (See Table 1).

Table 1: HIV-1 Subtypes from CHSDRSP Pilot Study, by Province

Province	Subtype						
	A n (%)	B n (%)	C n (%)	D n (%)	A/B n (%)	A/E n (%)	Total (%)
BC	6 (4.38)	119 (86.9)	9 (6.57)	1 (0.73)	1 (0.73)	1 (0.73)	137 (100)
Alberta	-	42 (93.3)	3 (6.67)	-	-	-	45 (100)
Saskatchewan	4 (3.88)	95 (92.2)	4 (3.88)	-	-	-	103 (100)
Manitoba	-	30 (93.7)	2 (6.25)	-	-	-	32 (100)
Newfoundland	-	33 (100)	-	-	-	-	33 (100)
Total	10 (2.86)	319 (91.1)	18 (5.14)	1 (0.29)	1 (0.29)	1 (0.29)	350 (100)

Source: Bureau of HIV/AIDS, STD & TB, LCDC, Health Canada, April 2000

- The results from CHSDRSP suggest that the proportion of non-B subtypes varies by geographic region. For example, whereas no non-B subtypes were identified from Newfoundland in the pilot study, up to 13.1%

of samples from B.C. belonged to this group (Note however, that subtype A has been identified in Newfoundland through reference services, See Table 2). Among the other pilot sites, non-B subtypes comprised 6.7%, 7.8% and 6.3% of the sampled population from Alberta, Saskatchewan and Manitoba, respectively.

- Preliminary analysis of the samples from BC suggest that those diagnosed with a non-B subtype infection tended to belong to ethnic groups other than white and Aboriginal persons (p=0.032), and were significantly younger (mean age, 33.4 years) than those infected with the HIV-1 subtype B (mean age, 38.6, p=0.031). No significant difference in gender, risk category, or area of residence were detected between those diagnosed with B and non-B subtypes.

- In the past two years, five provinces have submitted serological samples to the National Laboratory for HIV Genetics (NLHG), from individuals that were difficult to diagnose[5]. The results of these analyses are shown in Table 2. Of note, two subtype A samples and one subtype C sample were obtained from individuals born or infected in Africa.

Table 2: HIV-1 Subtype of Samples Submitted to NLHG

Province	Subtype	Year sample submitted to NLHG
Alberta	B	1998
Manitoba	C	1998
	C	1999
	B	1999
Ontario	A	1998
	B	1999
	A	1999
Nova Scotia	C	1998
Newfoundland	A	1999

Source: Bureau of HIV/AIDS, STD and TB, LCDC, Health Canada, April 2000

Distribution of HIV-1 subtypes in the United States and Europe

Non-B subtypes have also been introduced into other countries where HIV-1 subtype B used to predominate.

- As early as 1993, subtype D was reported in the United States[21]. Sentinel site surveillance of HIV in the U.S. has indicated the introduction of other non-B subtypes including subtypes A and subtypes F[22, 23]. Results from CDC's sentinel surveillance of strain and drug resistance in 1998, found at least 1.6% of persons newly diagnosed with HIV were infected with subtype A (n = 321)[24].

- In Sweden, until 1984, the HIV epidemic was almost entirely caused by subtype B, however by 1993, non-B subtypes, accounted for 30% of all new infections[25]. A study conducted in Spain suggests that between 1993-98, 37.6% of individuals in the sample population (n=101) were infected with subtypes A, C, D, E, or F[26]. In a pilot study conducted in Germany, eight of 24 recent HIV-1 infections among German nationals (33%) were due to non-B subtypes including subtypes A, C, and E[27]. In England, subtypes A, C, D, and A/E have been identified[28], and in Belgium, subtypes A, C, D, F, G, and H were reported in 1996[29].

Comment

The introduction of variant HIV subtypes into Canada will invariably challenge existing diagnostic tests and interpretation algorithms. Depending on future findings related to the transmissibility, pathogenicity and treatment implications of various subtypes, it may also play a role in changing the nature of the HIV epidemic in Canada. It is therefore important to implement the systematic collection and analysis of data related to strain surveillance across Canada.

References

1. Mansky, LM & Temin, HM. *Lower in vivo mutation rate of HIV type-1 than that predicted from the fidelity of purified reverse transcriptase.* J. Virol. 1995; 69(8) 5087-94.

2. Subbarao S & Schochetman G. *Genetic variability of HIV-1.* AIDS 1996; 10(suppl A):S13-S23.

3. Simon F, Mauclere P, Roques P. et al. *Identification of a new human immunodeficiency virus type 1 distinct from group M and group O.* Nature 1998 4:1032-7.

4. Myers G, Korber B, Foley B, et al (Eds): *Human retroviruses and AIDS. A compilation and analysis of nucleic acid and amino acid sequences.* Los Alamos: Theoretical Biology and Biophysics, 1996.

5. Jayaraman GC, Archibald CP, Lior L & Sutherland D. *Integrating laboratory and epidemiological techniques for population-based surveillance of HIV strains and drug resistance in Canada.* LCDC Report. Can J Inf Dis March/April 2000 (in press).

6. Kanki PJ, Travers KU, Mboup S, et al. *Slower heterosexual spread of HIV-2 than HIV-1.* Lancet 1994;343:943-6.

7. Andreasson PA, Dias, F, Naucler A, et al. *A prospective study of vertical transmission of HIV-2 in Bissau, Guinea-Bissau.* AIDS 1993; 7:989-93.

8. The HIV Infection in Newborns French Collaborative Study Group. *Comparison of vertical human immunodeficiency virus type 2 and human immunodeficiency virus type 1 transmission in the French prospective cohort.* Pediatr Infec Dis J 1994; 13:502-6.

9. Adjorlolo-Johnson G, De Cock KM, Ekpini e et al. *Prospective comparison of mother-to-child transmission of HIV-1 and HIV-2 in Abidjan, Ivory Coast.* JAMA 1994; 272:462-6.

10. Mastro TD & de Vincenzi I. *Probabilities of sexual HIV-1 transmission.* AIDS 1996; 10 (suppl A):S75-82.

11. Shaffer N, Roongpisuthipong A, et al. *Maternal viral load and perinatal human immunodeficiency virus type 1 subtype E transmission, Thailand.* J Infect Dis 1999; 179:590-99.

12. Wasi C, Herring B, Raktham S et al. *Detrmination of HIV-1 subtypes in injecting drug users in Bangkok, Thailand, using peptide-binding enzyme immunoassay and heteroduplex mobility assay: evidence of increasing infection with HIV-1 subtype E.* AIDS 1995; 9:843-9.

13. Hu DJ, Buve A, Baggs J et al. *What role does HIV-1 subtype play in transmission and pathogenesis? An epidemiological perspective.* AIDS 1999; 13:873-81.

14. Pepin J, Morgan G, Dunn D et al. *HIV-2 induced immunosuppression among asymptomatic West African prostitutes:evidence that HIV-2 is pathogenic, but less so than HIV-1.* AIDS 1991;5:1165-72.

15. Whittle H, Morris J, Todd J et al. *HIV-2-infected patients survive longer than HIV-1-infected patients.* AIDS 1994; 6:803-7.

16. Bernier L, Lamothe F, Bruneau J et al. *Analysis of HIV-1 sequence diversity in infected IDUs and MSM from Montreal.* Eighth Annual Canadian Conference on AIDS, Vancouver BC May 1-4 1999. Can J Inf Dis 1999; 10 (suppl B): 104A.

17. Major C, Calzavara L, Cassol S. *Strain surveillance and genotyping, POLARIS, Ontario.* Proceedings of the Joint HIV/AIDS and STD Meeting, Bureau of HIV/AIDS, STD and TB. LCDC. Health Canada. Calgary, AB, Nov. 17-20 1999.

18. Montpetit ML, Ratnam S, Campbell C et al. *Molecular epidemiological analysis of Human Immunodeficiency Virus type 1 in Newfoundland, Canada.* AIDS-Res-Hum-Retroviruses, 1998; 14(13):1205-9.

19. Montpetit M. *HIV-1 subtype A in Canada.* AIDS-Res-Hum-Retroviruses. 1995; 11(11) 1421-2.

20. Alexander C, Dong W, Chan K, et al. *HIV Non-B subtypes in a large North American cohort: prevalence and response to antiretroviral therapy.* Seventh conference on Retroviruses and Opportunistic Infections. San Francisco, CA. Jan. 31-Feb 3 2000. Abstract #174.

21. Gao F, Yue L, Hill SC et al. *HIV-1 sequence subtype D in the United States.* AIDS-Res-Hum-Retroviruses 1993; 10:625-7.

22. Irwin KL, Pau CP, Lupo D et al. *Presence of Human Immunodeficiency Virus (HIV) Type 1 Subtype A Infection in a New York Community with High HIV Prevalence: A Sentinel Site for Monitoring HIV Genetic Diversity in North America.* J. Infect Dis. 1997; 176:1629-33.

23. Weidle PJ, Ganea CE, Pienniazek D et al. *Prevalence of HIV-1 Group M, non-B subtypes in a Bronx, New York community: A sentinel site for monitoring HIV genetic diversity in the United States.* 12th World AIDS Conference. Geneva. June 28-July 3. 1998. Abstract # 13225.

24. Zaidi I, Weinstock H, Kalish ML et al. *Surveillance for HIV-1 subtypes in the United States, 1998-present.* 7th Conference on Retroviruses and Opportunistic Infections. Jan 31-Feb 3, 2000. Abstract # 215.

25. Sonnerborg A, Durdevic S, Giesecke J et al. *Dynamics of the HIV-1 Subtype distribution in the Swedish HIV-1 epidemic during the period 1980 to 1993.* AIDS-Res-Hum-Retroviruses 1997; 13(4):343-5.

26. Holguin A, Rodes B, Dietrich U, Soriano V. *Human immunodeficiency viruses type 1 subtypes circulating in Spain.* J Med Virol 1999; 59(2):189-93.

27. Dietrich U, Ruppach H, Gehring S et al. *Large proportion of non-B HIV-1 subtypes and presence of zidovudine resistance mutations among German seroconverters.* AIDS 1997; 11(12):1532-3.

28. Arnold C, Barlow KL, Parry JV et al. *At least five HIV-1 sequence subtypes (A, B, C, D, A/E) occur in England.* AIDS-Res-Hum-Retroviruses 1995; 11(3): 427-9.

29. Fransen K, Buve A, Nkengasong JN et al. *Longstanding presence in Belgians of multiple non-B HIV-1 subtypes.* Lancet 1996; 347:1403.

Health Canada Santé Canada

HIV/AIDS *Epi Update*

Bureau of HIV/AIDS, STD and TB Update Series
Laboratory Centre for Disease Control

April 2000

Primary HIV Anti-retroviral Drug Resistance in Canada

Introduction

In Canada, the use of highly active anti-retroviral therapy (HAART) is wide-spread. The main drugs used in HAART are reverse transcriptase (RT) inhibitors [the nucleoside analogue reverse transcriptase inhibitors (NRTIs) and the non-nucleoside reverse transcriptase inhibitors (NNRTIs)], and protease inhibitors (PIs). As the names suggest, NRTIs and NNRTIs reduce the activity of RT which is required to make a double stranded DNA copy of the HIV RNA genome. PIs function against protease which cleaves long chains of proteins so they can be properly assembled into the new virions before their release from the infected cell.

The development of viral resistance is largely due to mutations in the genes encoding HIV RT and protease. These mutations result in altered enzymes that are more resistant to the action of anti-retroviral drugs. For a review of these mutations, their interactive effects and mechanisms of drug resistance, see Hirsh *et al* (1998)[1] and Rodriguez-Rosado *et al* (1999)[2].

Mutations in the HIV virus are largely a result of the error-prone activity of RT which is estimated to introduce an average of one error per genome per replication cycle or between 0.2 and 1 point mutation (one nucleotide substitution) each time the virus replicates[3]. In an established infection, an estimated 10 billion virions are produced per day[4]. Given this high replication rate and the rate of mutation, drug resistant variants usually comprise a small proportion of the viral population. These variants become the dominant population through the use of anti-retroviral drugs that do not completely inhibit viral replication and perhaps also due to selective pressures exerted by the immune system.

It is useful here to distinguish primary from secondary drug resistance. Primary drug resistance is resistance seen in HIV-infected individuals who have never taken anti-retroviral drugs and is presumably due to the transmission of a drug-resistant variant to that individual. In contrast, secondary resistance develops in HIV-infected individuals who are taking anti-retroviral drugs and is due to a number of factors including difficulty with adherence to HAART and incomplete anti-retroviral therapy[5]. This report provides an update on the prevalence of primary drug resistance in countries where HAART is widely used, including preliminary data for Canada.

The Canadian HIV Strain and Drug Resistance Surveillance Program

The Canadian HIV Strain and Drug Resistance Surveillance Program (CHSDRSP)[6] was initiated as an integrated group of projects aimed at enhancing the national surveillance of HIV. One of the central goals of this program is to monitor and assess patterns of HIV subtypes and primary HIV drug resistance in Canada. The epidemiologic

component of this program consists of an existing HIV surveillance database plus additional information collected to help interpret the laboratory information. The laboratory component involves the collection of blood samples from all new HIV diagnoses for a sensitive/less sensitive antibody assay to detect recent infections, and genotyping to identify HIV subtype and critical mutations in viral RT and protease associated with anti-retroviral drug resistance. The relationship between particular mutations and drug resistance characteristics is determined by reference to databases maintained at the HIV Database, Los Alamos, New Mexico and elsewhere.

Why conduct surveillance of primary HIV drug resistance?

Although HAART has led to a reduction in HIV-1 related morbidity and mortality in Canada and some other countries, there is a concern that its widespread use may result in increased transmission of drug-resistant virus. The first case of primary resistance was reported in 1993 with the transmission a zidovudine-resistant HIV-1 strain[7]. Since then many reports of transmission of drug resistant HIV strains have been published. [For an overview of these studies see a review by Wainberg & Friedland (1998)[8]].

What is less well understood is the prevalence of primary drug resistance and the variation of this prevalence over time, geographic area and population risk group. The CHSDRSP aims to address these questions and the resulting information can be used to develop guidelines for initial therapeutic regimens and to develop more effective HIV prevention strategies, including the prevention of vertical transmission.

Current Information on the Extent of Primary Drug Resistance

Canada

- Drug resistance testing of samples from newly diagnosed, treatment naive individuals has just been initiated under CHSDRSP. To date, the RT and protease genes have been sequenced and analysed for 26 untreated subjects from Alberta who were newly diagnosed in 1998. Of these, only three individuals (11.5%) had virus with entirely wild-type RT and protease genes. Two individuals (7.7%) had critical mutations associated with high level drug resistance. One of these individuals (3.8%) harboured virus with an amino acid substitution in RT (T69N) associated with resistance to the NRTIs zalcitabine and didanosine. The other subject (3.8%) harboured virus with mutations in RT (M184V) and protease (M46I), associated with high level resistance to the NRTI lamivudine and to the PIs indinavir, nelfinavir, and ritonavir, respectively. One individual (3.8%) had mutation A98G in RT, associated with low level resistance to the each of the available NNRTIs. The remaining 20 individuals (76.8%) had other amino acid substitutions commonly found in untreated persons, and which by themselves are not associated with resistance. These were seen in sequences encoding both RT (A98S, V179I, L210W) and protease (L10V/I, M36I, L63P/Q/S, A71V, V77I, I93L).

- The BC Centre for HIV Excellence has carried out two studies to investigate the prevalence of drug resistance. In the study of recent seroconverters from the Vancouver Injection Drug Use Study (VIDUS), no mutations associated with resistance were found among the RT and protease genes sequences (n=54 and 51, respectively)[9]. In the second study of drug-naive individuals seeking treatment, 19 (4.6%) of 416 and 20 (4.6%) of 438 individuals had mutations associated with resistance to RT inhibitors and PIs, respectively[10].

- In Ontario, among ten seroconverters enrolled in the POLARIS study between September 1997 and August 1999 from whom RT and protease genes have been sequenced, two (20%) were found to be infected with virus showing key mutations to NNRTIs[11]. The remaining eight had additional mutations in the RT and protease genes which, by themselves, do not cause drug resistance.

- In the Quebec Primary Infection Study, a high prevalence of resistance to PIs and RT inhibitors was found in individuals newly infected with HIV via injection drug use (n=21) and sexual transmission (n=56) between 1997-99[12]. Among injection drug users, infection with virus resistant to PIs and RT inhibitors was 24% each, among sexual transmissions, these proportions were 12% and 22%, respectively. Transmission of multi-drug resistance (NRTI, NNRTI, and PI) was found in eight (9.5%) individuals.

Other Countries

- Boden *et al* (1999)[13] conducted a study of 80 individuals infected with HIV between July 1995 and April 1999. These individuals were identified about 1.7 months post-infection. Of the sample population, 16.3% had genotypes associated with drug resistance to one of the NRTIs, NNRTIs or PIs (10, 6, and 2 persons, respectively). Multi-drug resistance was identified in 3 individuals (3.8%).

- Little *et al* (1999)[14] investigated individuals infected between 1989-98, who had seroconverted within the past 12 months and with no more than 7 days of prior anti-retroviral therapy. Three (2%) of the sample population (n=141) were infected with virus containing resistance mutations: one with mutations to a NRTI, and 2 with mutations to an NRTI and PI

- Among 95 military personnel who enrolled in a seroconverter study between February 1997 and February 1998, eight of the 31 treatment-naive patients (26%) had primary drug resistant mutations[15]. Of these, three had mutations in the RT gene, four had mutations in the protease gene, and one had mutations in both the RT and protease genes.

- Among 82 individuals who were seen at the Geneva AIDS Centre, Switzerland, between January 1996 and July 1998, NRTI-resistant mutations were found in eight (10%) individuals and NNRTI-resistant mutations in one (1.2%) of the individuals[16]. Mutations to PIs were identified in three (4%) of 70 individuals. Transmission of a multi-drug resistant virus through unprotected sex was also identified in one individual.

- In a study of 135 treatment-naive HIV infected adults seen between 1992 and 1997 in the Centre de Recherche Public-Sante, Luxembourg, 16 patients (12%) were infected with virus resistant to NRTIs[17]. The prevalence of patients with drug resistant virus was 0% in 1992, 17% in 1993, 0% in 1994 (only 6 samples tested), 18% in 1995, 14% in 1996, and 9% in 1997.

- A cross-sectional study of treatment naive patient seen in 1993 (n = 75) or 1997 (n = 75) in out-patient clinics in three reference hospitals in Spain found primary resistance to NRTIs in ten (13.3%) patients in 1993 and nine (12%) in 1997[18]. All but two of these patients showed resistance to zidovudine.

- A report by Tambussi et al (1998)[19] found that among HIV-1 positive patients from Italy who seroconverted between 1987-94, 8% were infected with virus resistant to zidovudine. During 1996, this proportion increased to 20% and during 1997, it was 36% (study population = 98). Although the small number of patients analysed during 1996 and 1997 is an important limitation, the results indicate a progressive increase in the percentage of persons harbouring zidovudine-resistant virus at the time of HIV diagnosis.

- A study of recently infected, treatment naive persons from Germany (n=43) suggests a high prevalence of protease resistant mutations in the sample population[20]. Seventeen of 27 individuals (63%) contained resistance mutations for PIs. Two individuals (4.6%) were infected with zidovudine resistant virus.

- The Sydney Primary HIV Infection Study Group in Australia studied 61 patients who were identified soon after the onset of primary infection with HIV and found that 5 (8.2%)

were infected with virus resistant to zidovudine[21].

Comment

The transmission of drug resistant HIV strains is becoming more widespread in countries where HAART is used. Although the interpretation of results is difficult and evolving, persons infected with drug resistant variants of HIV may be at increased risk of drug failure despite being therapy-naïve since complete suppression of the virus could be compromised if individuals are treated with drugs to which their virus is resistant. Surveillance of primary drug resistance is needed not only to develop guidelines for initial therapy but also to better understand and prevent the transmission of resistant varian

References

1. Hirsh MS, Conway B, D'Aquila RT et al. *Antiretroviral Drug Resistance Testing in Adults with HIV Infection.* JAMA 1998; 279(24):1984-91.

2. Rodriguez-Rosado R, Briones C, Soriano V. *Introduction of HIV drug-resistance testing in clinical practice.* AIDS 1999; 13:1007-14.

3. Mansky, LM & Temin, HM. *Lower in vivo mutation rate of HIV type-1 than that predicted from the fidelity of purified reverse transcriptase.* J. Virol. 1995; 69(8) 5087-94.

4. Perelson AS, Neumann AU, Markowitz M et al. *HIV-1 dynamics in vivo; virion clearance rate, infected cell life-span, and viral generation time.* Science 1996; 271:1582-86.

5. Pomerantz RJ. *Primary HIV-1 resistance. A new phase in the epidemic?* JAMA 1999; 282(12) 1177-79.

6. Jayaraman GC, Archibald CP, Lior L, Sutherland D. *Integrating laboratory and epidemiological techniques for population-based surveillance of HIV strains and drug resistance in Canada.* LCDC Report. Can J Inf Dis March/April 2000 (in press).

7. Erice A, Mayers DL, Strike DG et al. *Primary infection with zidovudine-resistant human immuno-deficiency virus type 1.* N Engl J Med. 1993; 328:1163-65.

8. Wainberg MA, Friedland G. *Public Health Implications of antiretroviral therapy and HIV drug resistance.* JAMA 1998; 279(24):1977-83.

9. Alexander CS, Dong W, Schechter MT et al. *Prevalence of primary HIV drug resistance among seroconverters during an explosive outbreak of HIV infection among injecting drug users.* AIDS 1999; 13(8):981-5.

10. Alexander CS, O'Shaughnessy MV, Schechter MT et al. *The prevalence of HIV drug resistance in recently infected injection drug users and individuals seeking treatment in British Columbia.* Eighth Annual Canadian Conference on AIDS, Vancouver BC May 1-4 1999. Can J Inf Dis 1999; 10 (suppl B): B224

11. Cassol S, Calzavara L, Major C et al. *Primary HIV-1 resistance in the province of Ontario. 7th Conference on Retroviruses and Opportunistic Infections.* Seventh conference on Retroviruses and Opportunistic Infections. San Francisco, CA. Jan. 31-Feb 3 2000. Abstract #749.

12. Salomon H, Wainberg MA, Brenner B et al. *Prevalence of HIV-1 viruses resistant to antiretroviral drugs in 81 individuals newly infected by sexual contact or intravenous drug use.* AIDS 2000; 14(2):F17-23.

13. Boden D, Hurley A, Zhang L et al. *HIV-1 drug resistance in newly infected individuals.* JAMA 1999; 282:1134-5.

14. Little SJ, Daar ES, D'Aquila RT et al. *Reduced antiviral drug susceptibility among patients with primary HIV infection.* JAMA 1999; 282:1142-49.

15. Brodine SK, Shaffer RA, Starkey MJ et al. *Drug resistance patterns, genetic subtypes, clinical features, and risk factors in military personnel with HIV-1 seroconversion.* Ann Intern Med 1999; 131:502-6.

16. Yerly S, Daiser L, Race E et al. *Transmission of antiretroviral-drug-resistant HIV-1 variants.* Lancet 1999; 354:729-33.

17. Fontaine E, Lambert C, Servais J et al. *Fast genotypic detection of drug resistance mutations in the HIV-1 reverse transcriptase gene.* J Hum Virol 1998; 1(7):451-56

18. Gomez-Cano M, Rubio A, Puig T et al. *Prevalence of genotypic resistance to nucleoside analogues in antiretroviral-naive and antiretroviral-experienced HIV-infected patients in Spain.* AIDS 1998; 12(9):1015-20.

19. Tambussi G, Boeri E, Carrera P et al. *Prevalence of mutation associated to resistance with nucleoside analogues in a cohort of naive HIV-1 positive subjects during the period 1984-1997.* J Biol Regul Homeost Agents 1998; 12(1-2 Suppl) 32-4.

20. Dietrich U, Knechten H, Jager H et al. *High prevalence of protease resistant mutations in therapy-naive HIV-1 positive German seroconverters irrespective of viral subtype.* 12th World AIDS Conference, Geneva. June 28-July 3, 1998. Abstract #41208.

21. Imrie A, Carr A, Duncombe C et al. *Primary infection with zidovudine-resistant human immunodeficiency virus type 1 does not adversely affect outcome at 1 year.* Sydney Primary HIV Infection Study Group. J Infect Dis 1996; 174(1):195-8.